AMERICAN MACHINIST

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Frey's New Brick and Tile Machine.

The accompanying engraving represents one of the latest improved machines for making brick and tile, made by the Eagle Machine Works, Bucyrus, Ohio. It has in its design features of excellence that have resulted from long practical experience in constructing this class of machinery, and is believed to do away with objectionable features of machines hitherto constructed. It belongs to the class of combined machines; that is, it will produce either tile or brick of any cross-section or size desired, within its compass.

The main frame, or part which holds the gearing and the lower concave, are cast in one continuous piece, thereby avoiding all tendency to get out of line; this also adds greatly to the stiffness of the whole machine. The upper concave is hinged to the lower one in a neat and substantial manner, and can be easily turned up to expose the main shaft and its clothing. The main shaft has extra long and heavy bearings entirely outside of its clay chamber, and there are no bearings within the chamber, thus avoiding a very troublesome feature.

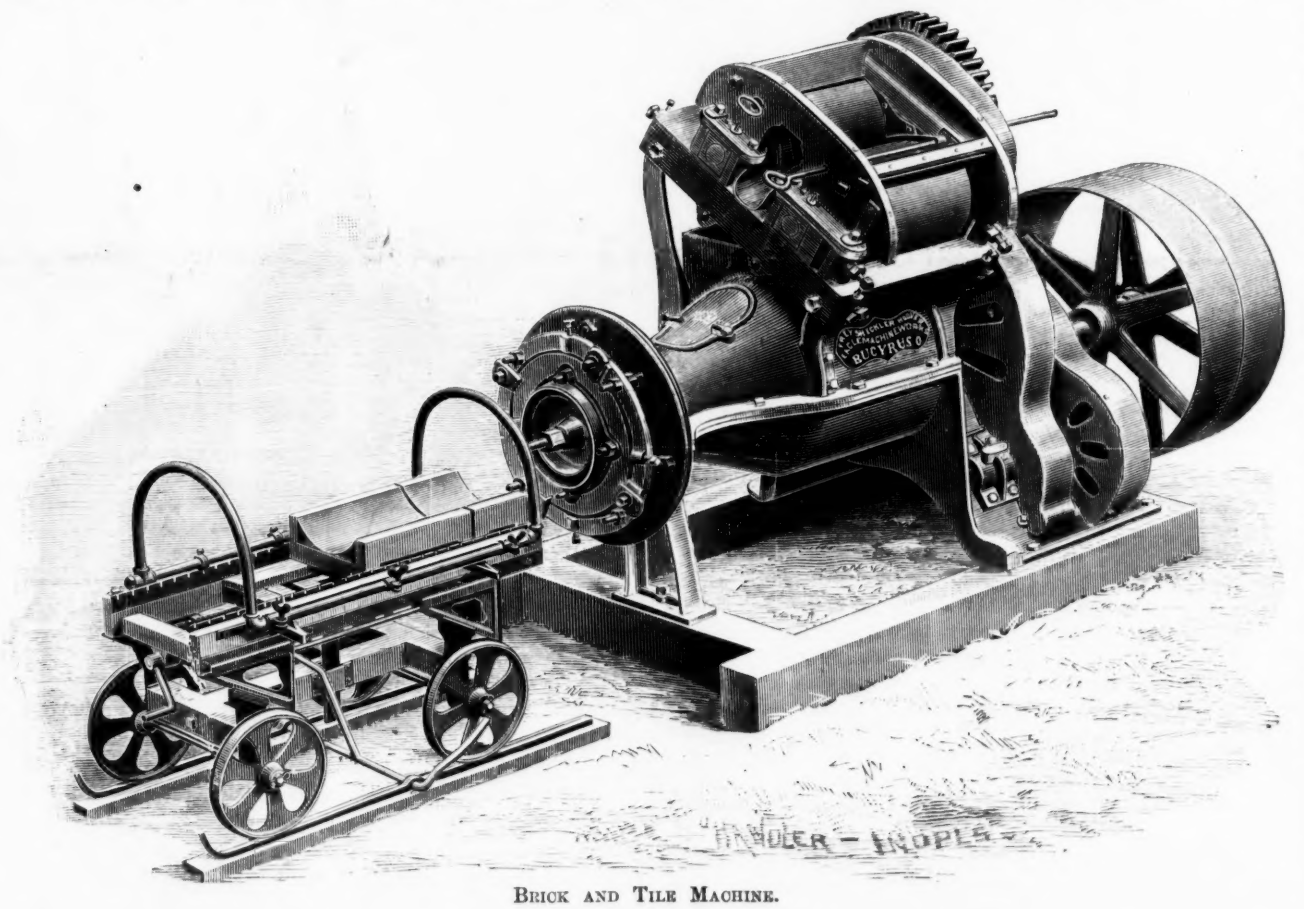
The cores for the different dies are suspended without the use of a bracket or cross, thereby correcting a well-known difficulty when using short or sandy clay. At the same time a bracket may be used, if the surrounding conditions make it desirable. The method of holding the core is peculiar to this machine, it being held by a stout rod, which passes through the main shaft and terminates in a threaded section, upon which is a deep nut. The front end of this rod is enlarged to a conical form, and is prepared to receive the core-pin proper. The conical portions of the rod have well-fitted gun-metal bearings. Any adjustment for wear can be made by simply turning the deep nut on the rear end of the rod.

There is a spiral rib or thread cast on the inside surface of the cylinder, or clay chamber, which acts so as to prevent the clay from revolving, while at the same time it tends to advance the contents of the chamber. A clay crusher is firmly mounted over the hopper. The special feature of this arrangement is the inclined position of the crusher frame, by which the hopper is entirely accessible for feeding directly into the machine, in case it is not necessary to use the crusher.

The machine can be furnished without this mounted crusher, as it can be used equally well with any other crusher.

As shown in the engraving, the crusher is driven from the master-wheel of the machine. In case it be desired, the crusher can be driven by a belt, independently of the machine.

There is also a perfectly adjustable die-holder, or front, for this machine. This front has all adjustments on the outside, in plain view of the operator; it has also a telescopic or longitudinal motion by which the die can be set out or in from the delivery auger; or the front can be tilted to correct any side tendency of the clay stream as it issues from the die.



BRICK AND TILE MACHINE.

A Co-operative Foundry Success.

There used to be a foundry up in New Hampshire which made nice gray iron castings. The product of this foundry was noted as among *the best* in the market. The proprietor got along in years, and took his son into the business. One day the old man died, and the son began to run the business.

Times got a little close, and the young man did not take in the dollars quite fast enough to satisfy his ambition. The old man used the best American and Scotch iron that the market afforded. When the young man began to economize (?) he worked in less Scotch and more poor American irons. It worked well for a short time; dollars came in faster, and more of them went into his pockets.

Soon there was trouble. The castings were not as soft as they used to be. Machinist always had a pic-nic when the old man's castings were on deck, but now iron was poor, hard and coarse. Lots of it got pitched into the scrap heap, and lots of hard words went after the shop.

Pretty soon the trade began to suffer. Customers saw into his plans for cheapness, and orders got scarce. A few men were discharged for want of work. One Saturday night there was no money to pay the hands, and no money the next Saturday, or the next, and so on for six weeks. The men struck. No pay, no work. He went down into Massachusetts and made an assignment to Smith. Smith sent up some new men and tried to run the shop. Then there was music. The moulders got mad, called on the sheriff and had the Boston men cleared out. The latter soon went to work again, only to be routed the second time. Smith told the strikers to go to work, and he would give them their back pay and wages every Saturday night. The men tried it. Saturday night came and no money. Another strike followed, with no prospect of a settlement. Then the men got tired of it, as business was not very good and they could not get good jobs elsewhere. Somebody said: "Let's go into the business ourselves." Soon an agreement was made, and nineteen moulders signed the papers.

Under the laws of New Hampshire, they were obliged to sell stock to outsiders also. Eighteen men bought stock in the concern; the mineteenth man got left, as all the stock was gone before he came up with his cash.

Land was bought, buildings built, and an engine bargained for. They spent $2,500 out of $4,000 for buildings, leaving but $1,500 for business. At that time, Smith offered the foundry for sale. Our young men bought it, and leased their new building.

Then they were short of cash, but they had friends who offered help. The stock was increased to $8,000 on September 12th, 1883, and on October 4, 1883, it was again doubled up to $16,000, where it now stands.

A president, treasurer, foreman and nine directors were chosen at yearly meeting. Their salaries were fixed at the same time. At the present time five of the directors work at the bench, and have done so since 1881.

After one of the original stockholders died, two of them tried to run the whole business, and were discharged forthwith. Stockholders and outsiders all obey the same rules. Even a director may be discharged if he deserves it.

One moulder is president; he does no work at the bench now, but is looking after the interests of the company. Their treasurer and manager was a moulder before the war.

So far, we have accounted for four of the nineteen original stockholders. One, it will be remembered, did not take stock after signing, thus leaving eighteen working in the foundry. Excepting the one deceased, they are all there to-day, and many more with them. Thirty-two moulders are working there to-day, and other help swells the number to forty-eight or fifty.

There are five directors working in the foundry, and they work well.

Of the eighteen men, who, in 1881, took forty shares of stock, we can say that twelve of them own eighty shares, or an average of $6\frac{2}{3}$ shares per man.

When they first started, they had no credit. They could not buy a ton of coal, or a car of iron unless they planked down spot cash. *Now*, if they want 200 tons of best American pig it comes when they write for it. All the drummers are offering time for them to buy and pay when they please.

The manager says their meetings are very harmonious. The men often have conflicting ideas, but the majority always rule without a word being said against it. The men are temperate—not a drunkard among them—and they all work steadily and make good pay.

The stock is well up in price. Last June some unsold stock was disposed of at auction to stockholders only. It sold at 110 to 117. It would probably have brought 120 from outsiders. There are a number of apprentices in the shop; they give the sons of stockholders the preference when they take apprentices, and then make them sign indentures.

The concern is prospering. One-tenth the net earnings are placed in a sinking fund, and will continue to be so deposited until

that fund shall exceed 30 per cent. of the capital stock.

For no year, has the annual dividend been less than six per cent. Eight, ten and eleven per cent. dividends have been earned; but the surplus over six or seven per cent. has been placed in the sinking fund.

A Heavy Hoisting Plant.

The engravings on pages 2 and 3 represent in three views one of the plants of heavy hoisting machinery constructed by the Iron Bay Manufacturing Company, Marquette, Mich. The perspective view is from a photograph of the plant as erected.

The friction driving bands are located upon the hoisting wheels; these wheels are attached to pinions running loose on engine shaft, through which motion is communicated to the winding drums by heavy gears 16 feet diameter, 12 in. face, which form one head of the drums.

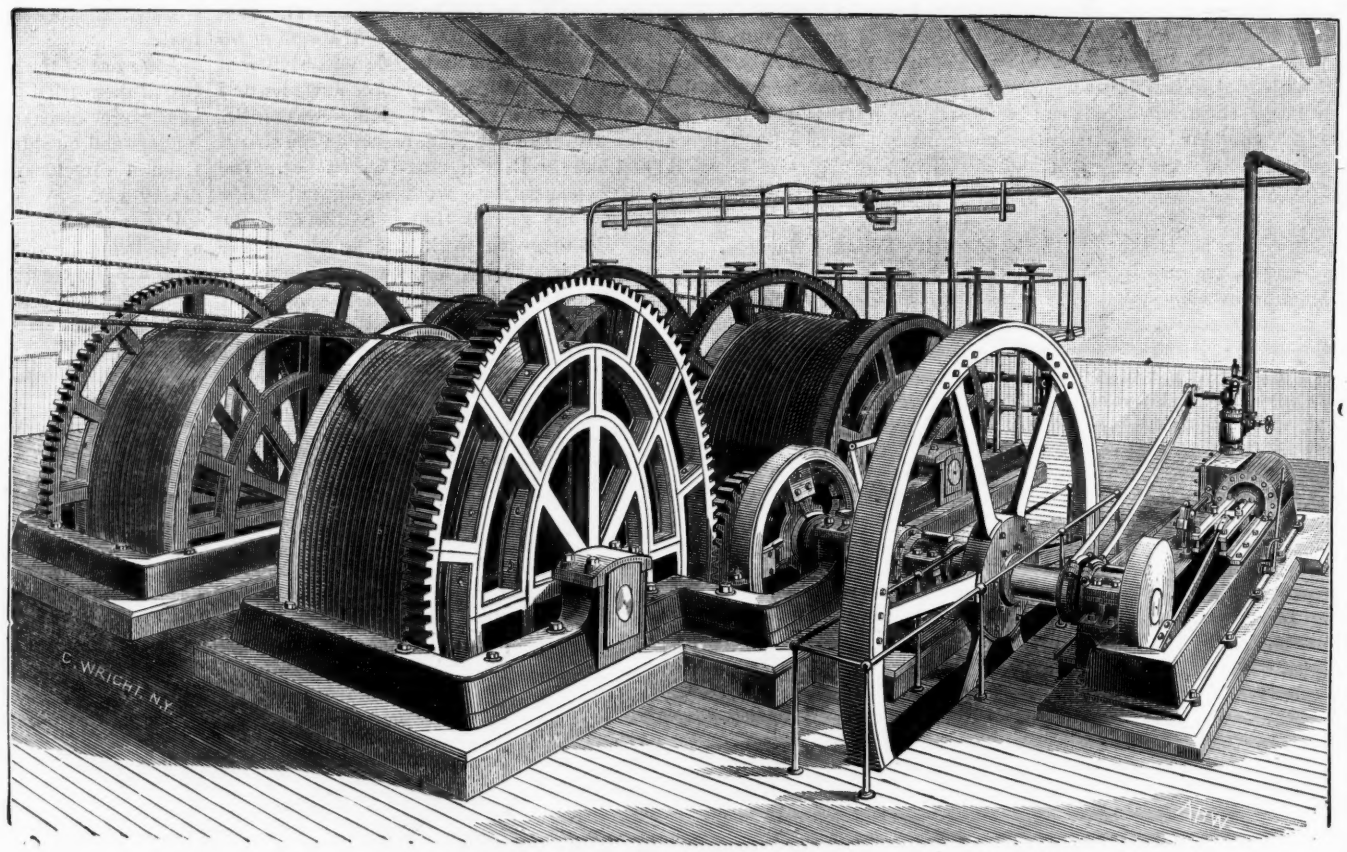
Two lowering brakes are used for each drum, one of which is attached to the hoisting wheel and the other is upon the drum. Each drum holds 2,000 feet of $1\frac{1}{4}$ in. wire rope.

The journal boxes are cast with the sole plate and are fitted with an adjusting device whereby the drums may be disconnected when not required for use. The operator stands upon a raised platform at one side of the plant.

The engines have cylinders 20 inches diameter, with a stroke of 30 inches. The two fly wheels are 14 feet diameter, and weigh 6 tons each. The normal speed is 75 revolutions per minute; they will hoist 15 tons at a speed of 400 feet per minute. The total weight of the plant is over 200 tons.

The elevation shows the external band friction, and the construction of foundation.

The plan shows the sole plates, which are continuous.



PERSPECTIVE VIEW OF HOISTING PLANT.

How many good machinists abuse a drilling machine, and do it unconsciously! Go into a shop, sit down on a horse, and watch the chap at the upright drill.

When he gets through the work, he don't go through easy. No. He keeps pulling down on the hand feed; the drill crashes through the bottom of the hole, and brings up on the table, or whatever is beneath the work.

Watch him change a drill. He picks up the wrench, slams it on the set screw, jerks out the drill, and fires it into a pile of drills lying around a drill-board. Now he hunts for the drill he needs; by and by he finds it. He jams it into the socket, throws his weight upon the wrench, and starts the drill to see if it runs true. It wobbles about $1\frac{1}{2}''$. He yanks the set screw again, pulls out the drill and looks at the shank.

It did not bear upon the filed seat. Machinist knew better than that. He knew that place was worn out long ago. He turns the drill half around, up goes the screw again, and the drill runs true within $\frac{1}{4}''$. A bat from the wrench while the drill is running completes the process, and machinist starts a hole and growls about the shop tools being "all bunged up."

"Let good enough alone" won't do for a machinist's maxim. When you get a job done so it is "good enough," then throw it into the river and begin over again.

Rolled Screws.

London *Iron* gives a verbal description of a machine, at the Inventions Exhibition, for making screws by rolling. It says:

"The screw threads are formed by rolling the blanks between two metallic surfaces, both cut so as to form dies which produce the thread. The blanks are formed in a separate machine, and are then placed, several hundreds at a time, in a hopper in which works a lifter having a vertical motion. At each dip the lifter fishes up out of the mass of blanks a number, which arrange themselves head upwards in a groove along which they are automatically carried to the forming portion of the machine. This consists of a revolving circular die, between which and a stationary section the blanks are carried forward, their revolution under compression producing the thread which is raised on the blank. This is effected without cutting or waste, and, in the machine we saw operated, at the rate of a gross, or 144 screws, per minute. The screw thus formed is found to possess many advantages over the ordinary screw with the cut thread. These advantages, besides being apparent on the face of it, are admitted by experts who have thoroughly tested the Harvey screw. In the first place it has a true gimlet point, drawing the screw into the wood in a straight course, and doing away almost entirely with the use of the gimlet. The thread is found to be much stronger, the metal being rolled up and compressed. In the ordinary screw at present in use, the fiber is cut and thereby weakened. Another point of great value is that the neck of the Harvey screw is of smaller diameter than the thread, whereas, in the ordinary screw, the neck is larger than the thread, necessitating in hard wood, the use of two gimlets to avoid splitting.

* * * * * * *

"We are informed that they will thread iron or Bessemer steel bolts, making them superior to any cut bolt. The tests which have been made show that the rolled thread is 18 per cent. stronger than the cut thread."

Fitting a key is a good test of a working machinist's ability. Set fifty men to fitting fifty keys, or splines, to the same key-way. When they are all done, you will not find three keys which fit alike. A key must fill the hole completely, or it is useless. If it bears a ridge here, a lump there, or is full of small places, that key is of no use. Make a "sliding" fit on the sides of key, and driving fit top and bottom, for most purposes.

Breaking Cylinder Heads.

"No. 103 blew out her cylinder head yesterday at 7:09 P. M.," wrote the engineer in his report; and this cylinder-head business is getting to be a nuisance. Since the elevated roads have been running, it has become dangerous. Forty or fifty pounds of cast iron coming down upon one's head unawares, is not desirable.

Nine-tenths of these accidents are caused by water in the cylinder. It would be practicable and not costly, to put on relief valves to take care of this water. Many marine cylinders are thus fitted, and why not put the valve upon the locomotive?

Valves at the lower part of the cylinder which will open outward at a pressure 20 lbs. above boiler pressure, would do much toward getting rid of this trouble.

At present, when heads blow out so frequently, some railroads have a cutting-off tool run into the cylinder head, just flush with the counter-bore. This weakens the head so that it gives way at this point, saving the studs and the flange of the cylinder.

More than once we have seen the head broken out clean, without cracking the flange. Put on relief valves and do away with the trouble entirely.

"Hard times" are apt to be hard on nice, delicate workmen. Perhaps business gets so dull that a nice toolmaker must go to work repairing old engines. For a time he uses tools tenderly. He is as careful with them as of old. It makes him wince to see the boys throw nice tools into a box, and then dump them into a drawer or on the bench.

Soon our man gets hardened. He begins to "don't care," and quickly gets as bad a tool smasher as any of the gang. "Hard times" not only spoil business, but they sometimes spoil the mechanic as well.

"Do you read the *Police News?*" is a good question to ask the young mechanic. We never learned how to grind lathe tools by reading that class of literature. It does not help the young mechanic, or the old one either. Why pay ten cents for a paper of blood and murder, when for the same sum you can get two papers, either of which will teach you points which will increase your value to your employer ten per cent. When you choose between the two, just bear in mind that, when your services increase in value, you are worth more, and know more than you would if you had read the murder papers.

We have received from J. H. Decker, secretary, a copy of the Report of Fifth Annual meeting of the American Water Works Association, held at Boston last April. It contains all the papers and reports read, and all the discussion had at that meeting. Among the papers and reports are: "Water Waste in its Different Phases" by the President Peter Milne, Jr., of Brooklyn; "Pumping Engines," by Wm. B. Sherman, report on "Kalamein Pipe," report on "Tests of Steam Coals," "What is Perfect Duty," by William Golding; "Thickness and Proportions of Cast Iron Pipes," by A. H. Howland; "Difficulties Encountered With Plumbers," by W. L. Cameron, (some examples of big bills and bad work were given in this paper); "Rules Governing Duty Trials of Pumping Engines," by Arthur G. Moore.

A catalogue of the membership is also included in the pamphlet before us.

It has been decided to compile and reprint the proceedings of the five annual meetings, (1881–1885) making one octavo cloth-bound volume of about 400 pages; conditional, however, on a guaranteed subscription of five hundred copies at $2 a volume. Every engineer and manager of waterworks in the country should have a copy. Subscriptions should be sent promptly to Secretary J. H. Decker, Hannibal, Mo.

The next annual meeting of the Association will be held in Denver, Col., in June, 1886. The topics for discussion are as follows: "Self-Closing Plumbing Work," by B. F. Stevens; "Water Meters," by L. A. Taylor; "Ground Water as a Source of Supply by Cities, and How Best Obtained," by A. C. Sekell; "Recording Gauges for Steam and Water," by Desmond Fitzgerald; "Discipline in the Pumping Station," by Charles B. Brush; "Fungus or Mossy Growth in Spring or Clear Water," by E. H. Keating; "Pumping Engines," by J. W. Hill and A. G. Moore; "Water for Public Supplies," by William Ludlow; "Tests of the Evaporative Power of Various Steam Coals," by J. C. Briggs and J. W. Hill; "Steam Boilers and Their Settings," by Charles A. Hague; "Steel Mains," by Geo. A. Ellis; "Private Water Companies," by H. F. Dunham; "Standard Specifications for Cast Iron Water Pipe," by Dexter Bracket, A. H. Howland and Peter Milne, Jr.

Locomotive improving has not yet reached its limit.

The size of engines has been doubled in cylinder, boiler and weight, yet the steam pressure has not kept pace with other improvements.

The highest pressure used is, we believe, 160 lbs. This, with $2\frac{1}{8}''$ nozzles and cylinders $18'' \times 24''$, will bear a large amount of thinking on the part of inventors.

We need higher steam pressure and larger exhaust tips.

The *Sanitary World* says technical education is what the plumber needs. No one supposes that he is in need of education in the matter of book-keeping and making out bills.

Better threads can be cut with lard or sperm oil than with black or most kinds of lubricating oils.

President Head on Steel Castings.

At the recent meeting of the Institution of Mechanical Engineers, in England, the president, Mr. Jeremiah Head, delivered an address on the "Relative Advantages of Iron and Steel," in the course of which, referring to castings, he said:

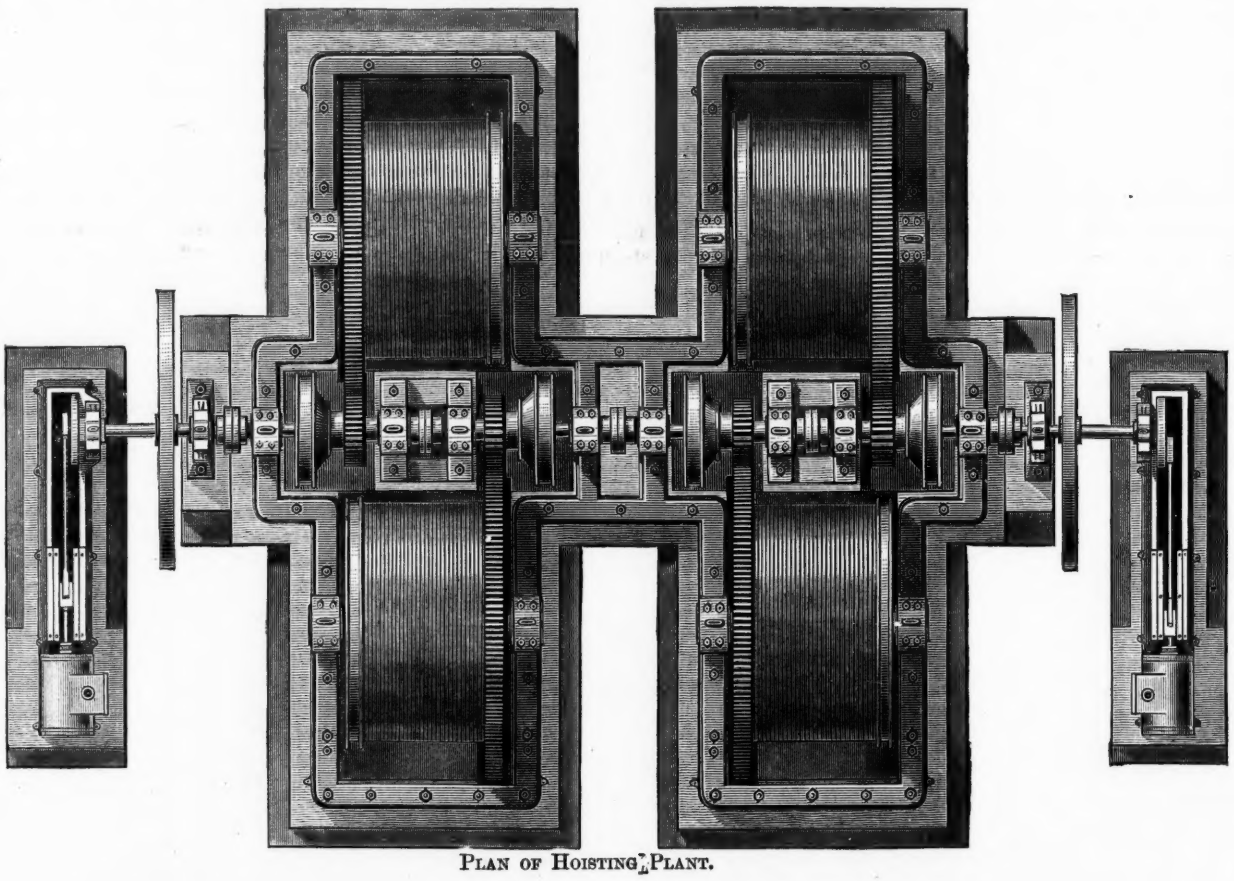
Steel castings began to come into extensive use about 23 years since. They were then made of crucible steel only, and no great size or weight was attempted. An urgent need had long existed for a material which could be cast in a mould, and which should yet have the toughness and tenacity of wrought iron. Portions of machinery that are subjected to severe strain, such for instance as the pinions and clutches of reversing rolling mills and the propelling gearing of steam-plow engines, are cases in point. No increase of substance would give the requisite strength so long as the material remained cast iron, inasmuch as the destructive force depending on the inertia of the parts would increase proportionately. But the difficulty was entirely obviated by the use of steel castings, for the strength and toughness in that case are largely increased without increasing the inertia. Before the time named, articles of enormous weight, such as screw-propellers, were occasionally made even of cast brass or gun metal, at a twelve-fold expense compared with cast-iron, in the hope of obtaining a slight increase of tenacity and some little ductility. The modern alloys of manganese, and phosphor bronze, and Dick's metal, which in some forms are claimed to be as strong and tough as wrought iron, were then unknown, and therefore the need of a better material for castings was more urgent than it would otherwise have been.

The cost of steel castings has been greatly cheapened latterly by the employment of the Bessemer and open-hearth processes. But the expectation which is occasionally expressed, that steel castings are about to supersede iron ones altogether, does not seem at all likely to be realized. For, in the first place, steel castings are from three to five times dearer than iron ones; and in the second place, whilst their general superiority is beyond question, iron castings have still the advantage in certain respects.

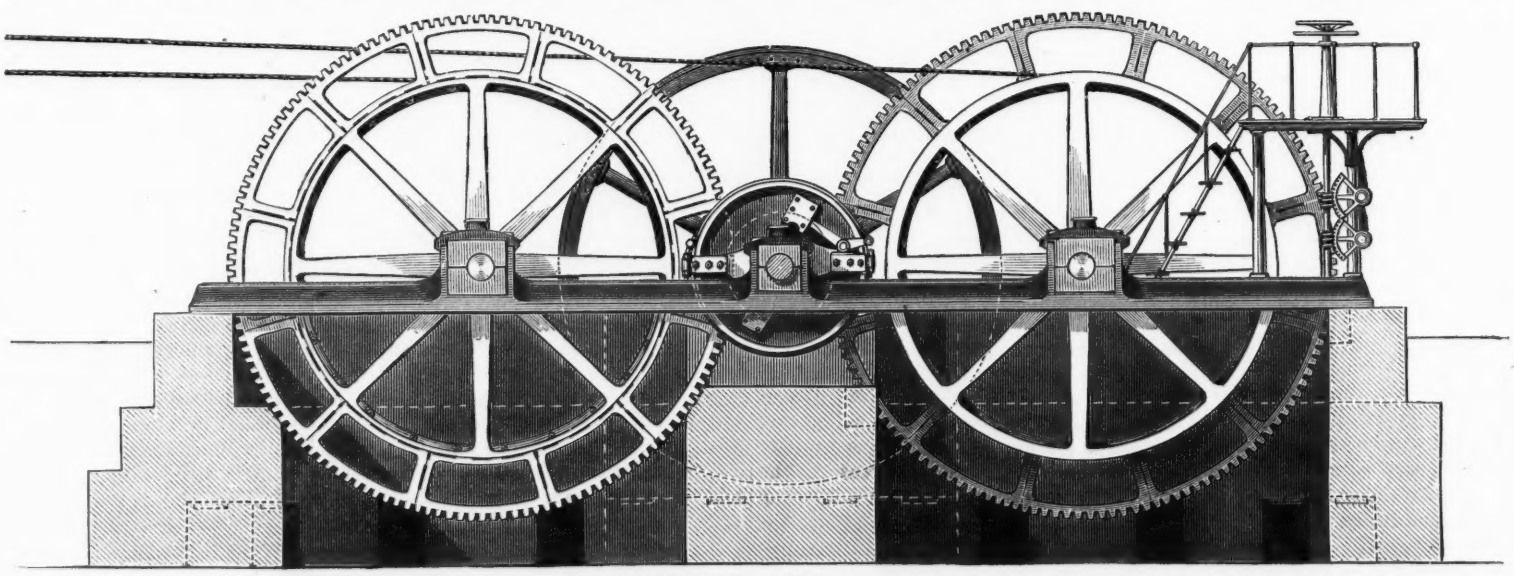
Steel castings are dearer than iron—1st, because the value of molten steel is considerably greater than that of molten cast iron; 2d, because, in order to get sound castings, there must be very much more waste in "deadheads" with steel than with iron; these are difficult and costly to remove, and entail a loss represented by the difference between steel-casting value and pig iron, which is greater than that between iron-casting value and pig iron; 3d, because the annealing process, without which steel castings are useless, is tedious and expensive; 4th, because the higher melting point of steel compared with iron necessitates more costly moulds. In consequence of these peculiarities the quantity of finished steel castings capable of being turned out in a given space, with a given number of hands and a given value of plant, is small compared with a corresponding output in iron castings. And as these impediments are mostly of a permanent character, the relative value of steel castings is not likely to be greatly altered in the near future.

As to those respects in which iron castings have the advantage—1st, steel castings seldom if ever have the fine surface, sharp edges and pleasing appearance of good iron ones. This arises no doubt from the higher temperature of the molten metal in the former case, and its destructive action on the surfaces of the mould. Annealing also usually detracts considerably from the appearance. 2d, both on the surface and internally steel castings are much more liable to cavities and blowholes. 3d, if not fully and equally annealed throughout, steel castings are quite unreliable and even treacherous. 4th, the delay in obtaining steel castings, owing to the time required for annealing, is so considerable as often, in pressing cases, to compel the reluctant substitution of iron ones. Besides the points just raised, there are many others which seem to force us to the conclusion that the art of iron-founding is in no danger of extinction, or even of serious diminution. In a majority of the cases where cast iron has hitherto been used, mass, and the stiffness due thereto, are required, rather than great tenacity or ductility. For columns, water and gas mains, engine frames, cylinders, condensers, bed-plates, lathe-beds, machine frames, bridge cylinders, railway chairs, household grates, roofing gutters, rain pipes, certain culinary utensils, cellar gratings, and for very many other purposes, steel would not answer better, if indeed so well as iron, even though there were no difference in price.

Again, for wearing surfaces, such as the motion blocks and bars of a steam engine, nothing works better than cast iron upon cast iron, if only the areas be sufficient; and this property is still more remarkable in the case of pistons in cylinders and slides on slide-faces, working as they often do for long periods, and remaining in excellent condition, with no other lubrication than the steam itself. There is not, so far as I am aware, any evidence to show that steel castings would answer at all in such positions. There are indeed purposes for which the one material is fittest, and others for which the other is fittest. Time will show; but meanwhile nothing like the wholesale superseding of cast iron by steel is in the least probable.



PLAN OF HOISTING PLANT.



ELEVATION OF DRUMS.

Prof. R. H. Thurston, Director of Sibley College, Cornell University, has sent out a small pamphlet descriptive of the college and its plan of construction. It is anticipated that in time the college may embrace schools of every branch of the mechanic arts and of mechanical engineering, which may assume prominence in connection with the development of the great industries of the country.

We quote from the pamphlet:

"The main building of Sibley College is constructed of stone, and is 160 feet in length and 40 in breadth, and three stories in height. It contains the lecture-rooms, drawing-rooms, and museums of the college, and is connected with a series of workshops, including a wood shop, machine shop, forge, foundry, and mechanical laboratory, with rooms devoted to various other purposes, and with the janitor's house.

"The wood-working shop is supplied with all needed hand and power tools, workbenches and accessories sufficient for sections of classes up to twenty-five or more in number, should it be found advisable to work so many together.

"The machine shop is supplied with lathes of various kinds, planers, grinding, drilling and shaping machines, a universal milling machine, fitted for cutting plane, bevel and spiral gears, spiral cutters, and twist drills, with additional tools and attachments for graduating scales and circles and for working various forms and shapes.

"In addition to the usual hand and lathe tools, there are instruments of the greatest accuracy consisting of standard surface-plates, straight-edges and squares of various sizes; a standard measuring machine reading to the ten-thousandth of an inch, a universal grinding machine for producing true cylindrical and conical forms, and a set of Betts' standard gauges.

"The smithy contains ten forges of the most approved pattern, and corresponding outfits of smiths' tools. The instruction embraces forging, welding, tempering, &c.

"The foundry is equipped for giving thorough instruction in loam and sand moulding, and the casting of iron and brass."

Together with more hopeful business prospects in this country come better accounts from England and other countries. The world is so connected at the present time by steam that it is no longer possible to find good times in any considerable portion of it and dull times elsewhere. This side the water we shall be glad to hear of improvement abroad. If we are entirely selfish in the matter, it means improvement everywhere, sooner or later. We hope for good times all round.

A railroad president, now deceased, used to tell with much enjoyment the story of the only instance within his knowledge wherein an honest and true reason was given for asking a "pass." One day the son of a prominent citizen came along—a brisk young chap—and said: "Mr. Doubletrack, I will be obliged to you if you give me a pass to Boston," and gave no reason at all. Mr. Doubletrack asked his young visitor: "Why should you have a pass?" To which the rejoinder came promptly: "Well, I don't want to pay!" Astonished at this plain telling of the truth, Mr. Doubletrack gave him the pass.—*Philadelphia Press.*

Rotating and Revolving Bodies.

BY FRANK H. BALL.

The prolonged discussion of this subject through the columns of the AMERICAN MACHINIST, has brought out many interesting experiments. There has been, however, very little attempt to harmonize the apparent contradiction of these experiments.

Mr. John Coffin has given us a mathematical demonstration of a theory which covers the ground, but, perhaps, fails to make the subject clear to many.

The apparent contradiction which experiment develops may be illustrated by Figs. 1, 2 and 3. Each figure represents a disk, *D*, having a center of gravity at *A*, and an axis *B*, this axis being carried at its extremities by rigid supports *S S*. Let Fig. 1 represent the disk at rest. Now, if it be made to rotate on the axis *B*, as shown by an arrow, the center of gravity moving in a circle will seek to leave this circle and move in a tangent, and in so doing the axis will be deflected toward the center of gravity, as shown in Fig. 2. In this case the point of greatest prominence on the disk will be on the side having the greatest weight.

It is found, however, that, under certain conditions, the disk will assume the position shown in Fig. 3, in which the axis is deflected away *from* the center of gravity, instead of toward it, and the point of greatest prominence is on the light side. This phenomenon has led Mr. Seymour and others into a train of false reasoning and false conclusions, among which is the statement that the effect of counterbalance in steam-engine practice is to throw the shaft toward the light side, etc.

Figs. 2 and 3 represent diametrically opposite results, apparently from like causes. In Fig. 2 the center of gravity is seeking to recede from the axis of rotation, but in Fig. 3 it has taken a position at the very point from which it seemed trying to escape. It will hardly do to explain this by claiming that at one rate of speed the center of gravity seeks to recede from the axis of rotation, and at another to approach it. The laws of physics don't blow hot and blow cold in that way.

Let us assume that matter, when in motion, always seeks to move in a straight line, and that if constrained to depart from a straight line, it exerts a force due to the measure of this departure. Then if matter move in a path around a center of motion, it will unceasingly strive to leave this center and move in a straight line or tangent. This is centrifugal force.

If the atoms composing a body move in a path around its center of gravity, each atom, by its centrifugal force, will strive to tear itself asunder from the other atoms, and pursue its own tangent, but the mass, as a whole, will not seek to leave its field of rotation. If, however, the *mass* move in a path around a center not coincident with its center of gravity, as the earth revolving around the sun, then the mass as a mass will seek to pursue a tangent. The distinction must be clearly borne in mind. Let us call one a rotating body and the other a revolving body. Then a rotating body is one whose center of gravity is its center of motion. A rotating body may also be a revolving body, as the earth, which rotates on its axis and revolves around the sun*.

If, then, the center of gravity of a rotating body has a path of motion, we know that the mass has a motion other than rotation. Therefore, what is called an unbalanced rotating body is more properly a body that both rotates and revolves, the path of its center of gravity being its orbit of revolution. This is very evident when the center of the orbit is outside the boundaries of the mass, but it is none the less true, no matter how near the center of the orbit approaches the center of gravity, until the two coincide, when the revolution is merged in rotation, and the body is said to be in balance. Fig. 4 is given to further illustrate the action of a mass that both rotates and revolves.

Let us suppose this to be a disk revolving around its axis *B*, as in Fig. 1, and having its center of gravity at *A*. Here is a case where a mass rotates about its center of gravity *A*, and the center of gravity revolves around a fixed center *B*, each rotation occupying exactly the time of one revolution.

Imagine this disk to be suddenly released from its axis in the position shown. The centrifugal force of the mass developed by the revolving of the center of gravity *A*, around the center *B*, will at once impel the mass on the tangent *A*, *H*. Now, we notice that the center of gravity has ceased to revolve, and pursues the tangent. The rotation of the mass about the center of gravity continues as before, and it will be found to rotate once while the center of gravity moves a distance on the tangent equal to its former path around the fixed center *B*. This theory is fully illustrated in the AMERICAN MACHINIST of January 3d. The result of these two motions will be that, while the center of gravity follows the straight line, the point *B* will follow the dotted line, which will be recognized as the same line that represents the path of any given point on the circumference of the wheel of a moving railway train.

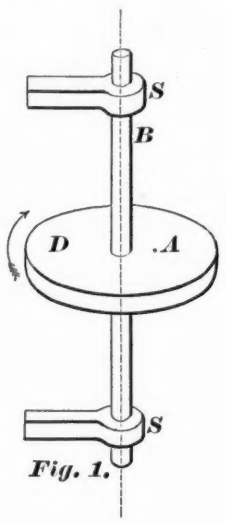


Fig. 1.

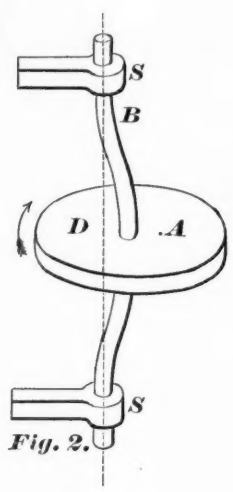


Fig. 2.

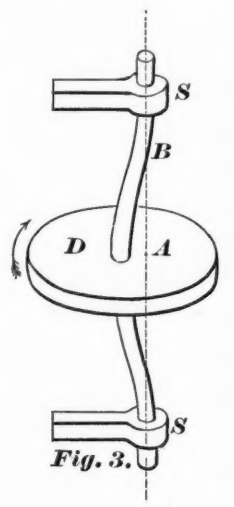


Fig. 3.

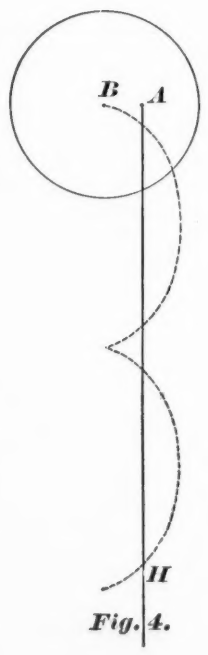


Fig. 4.

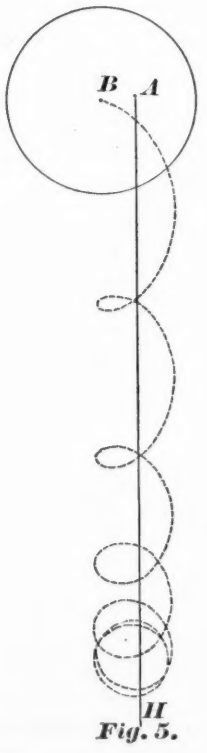


Fig. 5.

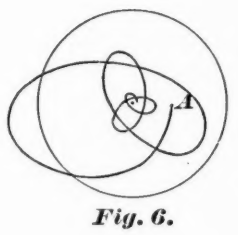


Fig. 6.

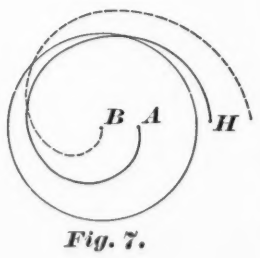


Fig. 7.

Let us suppose Fig. 5 to represent the same conditions as Fig. 4, except that after release the motion on the tangent is gradually resisted, until it finally ceases, as shown, when we shall find the body simply rotating around its center of gravity, and, therefore, the light side will be the prominent side.

Reviewing the case, we started with what is called an unbalanced rotating body, in which the prominent side was the heavy side, and later found the body in balance, and the light side prominent. The conditions which brought about this change were first, a sudden release from revolution, allowing the mass to move on a tangent. Then a restraint felt at the center of gravity, opposing tangential motion, finally bringing the center of gravity to rest. This theory presents no contradictions, and it is safe to say that something corresponding to this order of things will be found in every case where the light side of what is called an unbalanced rotating body is found to be prominent.

Referring again to Figs. 1, 2 and 3, let us look for the sudden release and subsequent restraint felt at the center of gravity. Let us investigate the last mentioned first, and for that purpose let us suppose a sudden release in Fig. 2 by the axis suddenly becoming flexible. If it could be perfectly flexible the disk would move as shown in Fig. 4, and the flexible axis would follow the dotted line from *B*, thus revolving around the center of gravity, and at each revolution the flexible axis would be more deflected from the original position at *B*, or the line of its stationary supports. If, however, the flexible axis offered any resistance to this increasing deflection, that resistanee would be felt at the center of gravity in opposition to the tangential motion, because the flexible axis is describing a circle around the center of gravity.

Here, then, we have the conditions of Fig. 5, and the effort of the flexible axis to resume a position in line with its supports would soon overcome the motion on a tangent and bring the disk back to the field it had left.

Inasmuch as the flexible axis is moving in a circle around the center of gravity, the position of rest would be one where its deflection would be equal in all directions, in which position the center of gravity would be in line with the stationary supports.

As a matter of fact, Fig. 5, although serving to illustrate the theory, hardly represents what takes place, for the reason that the restraint of the flexible axis in opposition to the motion on the tangent *A H*, is not felt along the line *A H* in the the direction of *A*, but constantly toward the point *B*, as a fixed point on the line of the supports, from which line the axis is being deflected. The result is, that the line *A H* is curved toward *B*, and may follow the path indicated in Fig. 6, or one that resembles it. The return to its original field may, perhaps, be represented by the continuation of this line, probably crossing and recrossing the field before finally coming to rest.

Fig. 7 illustrates the change of position within a still smaller field. If the points *A* and *B* are in close proximity, a release of much smaller extent may allow the change. It is only necessary that there shall be a sudden release of sufficient amplitude to allow the point *B* to pass around to the outside of *A*, which, having done once, it will continue so to do, and will therefore bring the center of gravity *A* into a position in line with the supports *S S*, as shown in Fig. 3.

In Fig. 1, if we suppose the axis and its supports to be absolutely rigid, we preclude the possibility of either side of the disk becoming prominent when in motion, and it will run, to all appearance, as though in perfect balance.

This condition is an impossible one, as no axis can be perfectly rigid, and no supports immovable. Then, in Fig. 1, we know that if the disk be set in motion the axis will at once be more or less deflected toward the center of gravity, as shown in Fig. 2. We know, also, that the supports will themselves describe small circles, or vibrate more or less violently.

In Fig. 2, if the supports were absolutely rigid, the real axis would be a line passing through the center of these supports, but, as they cannot be absolutely rigid, the real axis then is an imaginary line passing through the center of the small field of motion in which these supports move. These supports, together with the deflected axis, exert an effort on the disk toward the real axis, and the centrifugal force of the mass felt at the center of gravity is in just the opposite direction; therefore the deflected axis, and its supports, are naturally found directly between the center of gravity and the real axis. An increase of speed, or a decrease of the strength of the axis, will simply increase the radius of the circle in which they move without changing their relative positions.

It will be impossible to move the flexible axis around to the outside of the center of gravity, thus changing their relative positions without a sudden release, thus allowing the mass to pursue a tangent, as shown in Fig. 5, or move in a curve with rapidly increasing radius, as shown in Fig. 7.

This sudden release may be effected by a sudden increase of speed, causing a rapid increase of deflection of the axis, thus allowing the center of gravity to move in the line shown in Fig. 7. A more common cause, however, for the change under consideration is a more obscure one, and is found in the supports which carry the flexible axis.

These supports, we have seen, have a small field of motion, and are supposed to move in unison with the flexible axis and center of gravity.

It is often found that these supports, owing to their surroundings, cannot continue to revolve or vibrate in unison with the revolution of the center of gravity.

When in this discordant condition the real axis is at times between the center of the supports and the flexible axis and each return to harmonious revolution in which the centers are all on the same side of the real axis, results in a momentary release equal to the diameter of the small circle in which the supports move.

If the mass be very nearly in balance this release may be sufficient to bring about the result shown in Fig. 7. The extent of the release necessary in any case depends entirely on the distance between the center of gravity and the axis, and unless the two very nearly coincide, it is practically impossible, even with other conditions favorable, to make an unbalanced mass rotate with the light side prominent.

* I refrain here from using the moon as an illustration, as Mr. Seymour, in his reply to my previous article, has announced to the world that the moon has no axis of rotation. I shall leave him to settle this with the astronomers, who have told us that the moon rotates once on its axis while revolving once around the earth, and who have supposed the fact was proven by noticing that the same side of the moon was always toward the earth.

Economy of Throttling Engines.

We take the following from the recently-issued catalogue of the Tabor Manufacturing Company (steam engine governors) as an argument in favor of a class of engines of which very little is written. What we extract was written by Mr. Harris Tabor.

* * * "One of the most important elements of steam economy is reduced clearance, or waste room, between the valve and the piston, when the latter is at the end of its stroke. At each stroke of the engine this waste room must be filled with steam before any pressure can be exerted on the piston. Up to the point of cut-off the steam contained in the clearance space gives no force to the piston, but simply acts as stuffing—as one would put paper in the empty space of a packing box—but beyond the point of cut-off it adds somewhat to the expansive force of steam, on account of its greater volume, but not at all in proportion to the amount needed to fill the waste room. In fact, we may say that the greatest gain that comes from the expansive force of steam, used to fill the waste room in a cylinder, is at the end of the stroke—just where it is the least effective.

"To illustrate, we will assume two engines, both 8″ × 12″—one with 5 per cent. clearance, and the other with 20 per cent., each engine fitted with a long-lapped valve to cut off at one-half stroke. The area, in round numbers, of an 8″ cylinder is 50 square inches, which would make the cubical contents of an 8″ × 12″ cylinder 600 inches, 5 per cent. of which would be 30 cubic inches—making 330 cubic inches of space which the steam must fill up to the point of cut-off—one-half stroke. Twenty per cent. of 600 equals 120 cubic inches, which, added to one-half the cylinder capacity, would make 420 inches, which must be filled with steam up to the point of cut-off in the cylinder with the largest clearance—making the amount of steam used in the two engines 330 cubic inches and 420 inches respectively. It would be unfair to let the comparison stop here, for there is a slight gain due to the expansion of the steam in the larger clearance; but, as said before, it bears no relation to the amount of steam used.

"In assuming 20 per cent. clearance, we have exaggerated the ordinary practice, but in many cases the amount is exceeded in small engines. It is safe to say, however, that 14 per cent. is frequently met with in single-valve automatic engines, and that few builders like to go below 10 per cent. in that type of engine, for the reason that compression varies with the cut-off, and, if the clearance be reduced below 10 per cent., the pressures on the crank and crosshead pins become too enormous when the engine is running under a light load. Now, it is possible to build throttling engines of the above dimensions with only 5 per cent. clearance; and, if we compare such an engine with a single-valve automatic with 10 per cent. clearance, we find the amounts of steam used up to one-half stroke would be 330 and 360 cubic inches—a gain so great that it neutralizes the greater expansion of steam in the automatic when it is cutting off earlier in the stroke and working under its best conditions. There are important economical gains in the throttling engine which we have not yet considered, viz., initial expansion and slightly superheated steam. By initial expansion we mean the expansion due to wire drawing before the cut-off takes place. * * * Slight superheating is also obtained by wire drawing, and to the engineer who has the proper conception of the loss due to condensation this means a great deal. So good authority as Professor Rankine said: 'The loss of head which occurs during the passage of steam from the boiler to the cylinder does not wholly represent wasted energy; for being expended in friction, it produces heat. So that steam which has had its pressure lowered by the resistances of passages, or, as it is called, has been wire-drawn, *is superheated* (that is, is at a temperature higher than the boiling point corresponding to its pressure, although lower than the temperature in the boiler).' 'Experiments made by Mr. C. W. Siemens prove that steam, after having been freely expanded, is superheated, or above the temperature of saturation corresponding to its pressure.' We are inclined to believe that, in addition to the heat due to friction, there is a gain of heat carried from the higher temperature in the boiler. The amount of superheat thus obtained is, of course, slight, but a small amount of superheat puts a decided check to the loss from condensation.

* * * "In comparing the two engines for durability, there can be no question as to the result. The more uniform pressure of the piston during its stroke in the throttling engine must count in its favor, while the higher initial pressure and the enormous compression in the automatic will soon make havoc unless the engine be thoroughly well made. In simplicity, that best element in design, nothing more can be desired in the slide-valve engine. For generations it has been a standard machine. Every engineer and machinist understands it, and it may be repaired in any machine shop. It only needs good governing to be the equal, in all ways, of its competitor."

Thomas Box, an English author of several practical works on engineering topics, through the popularity of which he became nearly as well known in this country as at home, died recently at the age of sixty-four years.

Turned Pins or Bolts vs. Split Pins for Brace Fastenings.

FROM "THE LOCOMOTIVE," PUBLISHED BY THE HARTFORD BOILER INSURANCE CO.

The manner in which a brace is attached to the head or crown-sheet of a boiler is a matter of the greatest importance, for unless it is well fastened, the best brace it is possible to make may be perfectly useless, and, in some cases, worse than useless.

Fig. 1 shows the method we recommend for the attachment of braces to the ordinary crow-foot, **T**, or angle iron. The holes through jaw of brace and crow-foot are drilled, not punched, and a turned pin or bolt, preferably a bolt, is fitted to the jaw.

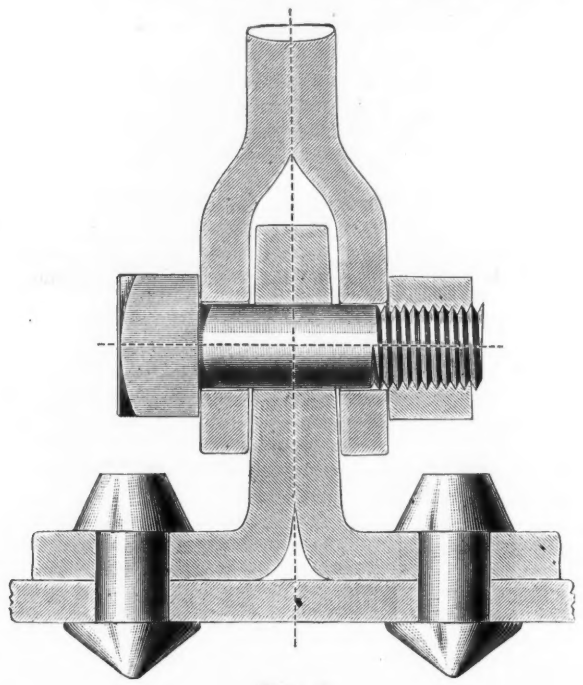


Fig. 1.

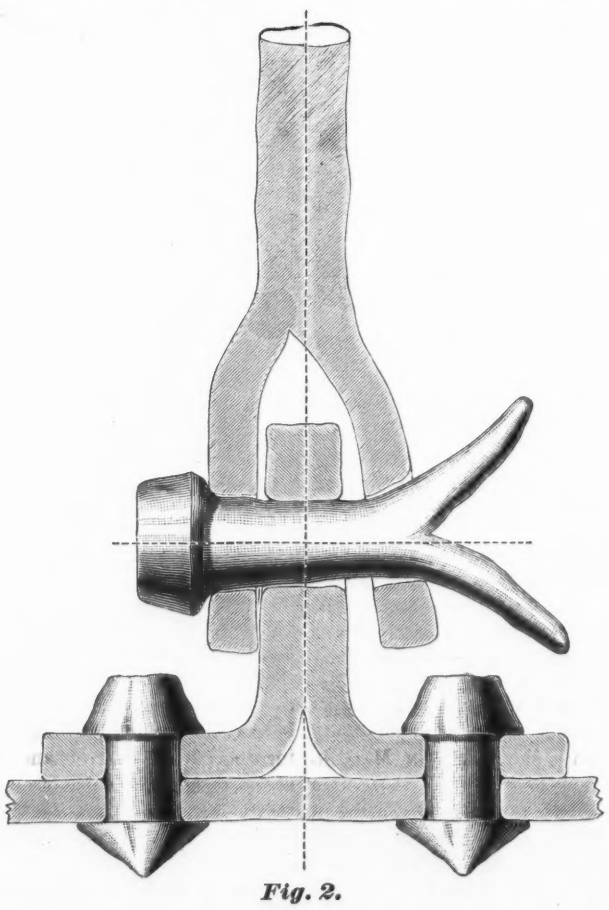


Fig. 2.

The nut screwed up into contact with the jaw of the brace prevents any spreading of the jaw which might occur.

Fig. 2 shows the jaw of a brace fastened to a crow-foot by a split pin. The drawing is not an imaginary sketch, but was made from an actual brace, as accurately as we could measure it. We have seen much worse cases many times.

These forged and split pins are generally at least one-sixteenth of an inch tapering, and the holes into which they fit being made with a drift-pin are in about the same condition. Then again, consider the fact that the holes hardly ever come fair, and the pin is driven into place whether they do or not, and it will readily be seen that the general bearing between it and the jaw of the brace will be very apt to be quite defective. "Skewing" is the word which best expresses its position in the majority of cases. And right here we would enter a strong protest against the practice which prevails in many shops of driving these pins in when the brace is not just the right length. Where it is done, it is not possible to obtain a uniform tension on the braces under any circumstances. We have known of cases where braces put on flat crown-sheets in this manner had to be all removed, owing to the fact that the unequal tension on some of the braces, caused by driving in these tapering pins, loosened up all the others. Several cases of this nature have been discovered by our inspectors, and the number of boilers sent out in this condition, which have never been subjected to impartial examination, is probably very great.

The consequences which may result, and, doubtless, in many cases have resulted from unequal tension on braces, are very serious. Suppose, for instance, that through unequal tension, two or three braces on a large head or crown-sheet take all the stress, or the greater portion of it. In the course of time suppose the brace becomes gradually weakened by corrosion, or, if fastened with a split pin which begins to straighten out, so that upon the boiler being subjected to a slightly greater pressure than usual (and it will be well to remember that under these circumstances a little increase of pressure on the boiler may be equivalent to a great increase of stress on the brace), one or more of these braces suddenly gives a little, through the jaw of brace spreading, or otherwise, then it is evident that a sudden stress will be brought to bear upon the adjacent brace or braces. Under these circumstances it would be quite possible for one or two braces to break suddenly, and this would be more than likely to be followed by the collapse of the entire crown-sheet, or the explosion of the boiler. Many explosions have probably been caused in this manner. There is no good reason for braces being put into a boiler with an injurious amount of unequal tension. If their length is just right it cannot exist. If a brace is too long or too short, it is a perfectly easy matter to upset or draw it out slightly, so that it may be just right, and then if the holes are not quite fair, use a reamer instead of a drift-pin to bring them fair, and there will be little chance for trouble.

"Burning" Phosphor-Bronze to Iron.

An experienced moulder who is not willing that his name should appear, or that the precise character of the work be known, writes, giving some interesting experience in "burning," as moulders call it, phosphor-bronze to both wrought and cast iron. His experience is that this metal will burn fluid to solid the most satisfactorily of any he has knowledge of. In casting the bronze to wrought iron, should any defects appear, they may be burned solid, and defects in iron castings may be mended in the same way that a moulder mends with iron. The phosphor-bronze appears to penetrate the pores of the iron, making a perfect union, quite free from defects.

Some of the soldering fluids used are injurious to tools and also to parts that have been laid on the bench where it has been used. The following recipe will do the work as well, and will not rust and tarnish any more than water would: Take two ounces alcohol and put it into a bottle, and add about a teaspoonful of chloride of zinc, and shake until dissolved. Use it in the same manner as the muriate of zinc, or muriatic acid and zinc. It has no bad smell.—*Sewing Machine News.*

One of our contemporaries in the sewing machine line complains that it requires too much space to publish all the inventions in their line, and pathetically asks inventors to "let up" a little. We do not think they will do it.

LETTERS FROM PRACTICAL MEN.

Petroleum Fuel on Steamers.

Editor American Machinist:

You ask how we "get steam in the first place to supply the steam jet mentioned in your description of apparatus for burning petroleum, as published in our issue of August 1st.?"

On our large steamer Solano there are two engines and two sets of boilers; there is always steam in at least one of the boilers, hence we are independent upon this boat, and can fire up at any time. But on the other boat, where there is no steam, when one or more boilers are blown out, we arrange the firebrick on the grate bars next to the door, say for a space of two feet in width, so that they may be removed easily, and we fire up with wood until ten or fifteen pounds of steam has been raised; then the bricks are laid back in place so as to prevent the air passing through the grates; the oil jet is then turned on. A. J. STEVENS,

General M. M. Southern Pacific Company.

Hints About Shop Tools.

Editor American Machinist:

If machine-shop proprietors would carefully watch the production of their tools, and, as soon as a machine fell behind the best practice of the day, either in amount or quality of work, dispose of or remodel it, their profits would be materially increased. "Kid" had the right idea when he altered his lathe to increase the feed, but his method was not just the best. Now, every time he changes his feed he must change a gear. Had he left the cones on the rod, and added enough to the end to put on a feed gear, he would still have had ready at all times a feed suitable for much work, and a gear feed that could be attached instantly whenever a coarse feed was needed.

A drill press that I remember well had a power feed, but no quick return, which made the production of holes on that press rather a slow matter, as it took a long time to screw the spindle up or down whenever the height of the drill point from the table was not suitable for the job in hand, to say nothing of the time lost in backing out of holes, starting the drill true, etc. The remedy in this case was a new shaft through the worm gear and feed pinion, long enough to admit of putting a friction disk and tightening nut upon one end, and a 16″ hand wheel on the other. A lever and ratchet were also attached to this same shaft, so that in the matter of small and short holes the production of the machine was more than doubled.

This leads me to speak of a communication from "Old Jour," which appeared in your paper about one year ago, stating that power feeds should be removed from all drill presses. He said that it took five minutes to drill a half-inch hole through a piece of cast iron one-half inch thick. At that same time I was drilling one and one-half inch holes in steel castings at the rate of one and one-fourth inch per minute, with power feed, and that, too, with the finest feed on the machine. I don't believe any man, unless on piece-work, would crowd a drill through stock at that rate with hand feed.

I like a good drill press, and I have almost surprised myself at the variety of work that can be done with one, if time and thought are used a little to rig up—milling, surfacing and profiling almost without end. When I get time to make drawings, I will try to show your readers some of the ways in which the drill press has helped me out.

F. S. JOHNSON.

Twisted Arithmetic—The Hog-Nozed Drill.

Editor American Machinist:

Brother Richards in AMERICAN MACHINIST of September 12, makes a touching appeal for help and co-operation in defending our "twisted arithmetic." Now, if it strikes Brother Richards in a tender place, how must it affect our lacerated feelings, which are supposed to be totally devoid of cuticle through the efforts of some of your esteemed correspondents, and one or two contemporaries. We appreciate the situation and detail our old friend "Tom," who, you will remember, was suspended for "using his chalk on his boot leg." Tom is anxiously waiting for Brother Richards to get another piece of chalk. Then Tom will figure up what is left of Mr. Dingley, if he can find him. We really must leave it with Tom, for Brother Goodyear has run over to have a quiet little "root" with the "hog-nose," and as we have had no experience with a drill larger than 2″, and none whatever with a "cannon drill," we will have to fly around and find a bit of soft ground to begin the root in. JAMES F. HOBART.

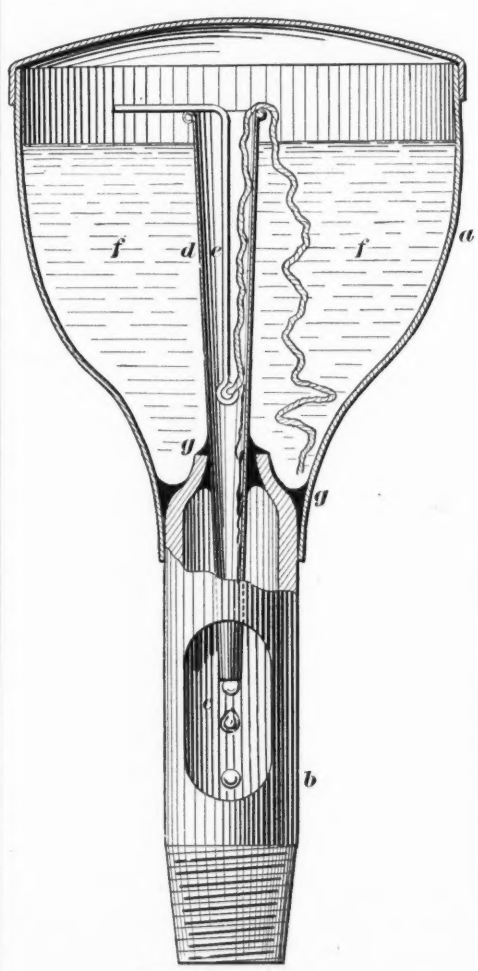
A Simple Sight-Feed Oil Cup.

Editor American Machinist:

I have had such success with the oil cup, shown in sketch, that it prompts me to send it, in hopes that my experience may benefit some one else.

Some three months ago I was obliged to adopt some sort of continuous oiler for electric-light plant, and this one seems to fill the bill, exactly.

Referring to the engraving, from rough sketch, *a* is the body of the oiler, and *b* is a



SIGHT-FEED OIL CUP.

short piece of brass pipe, which may be ¼″ or ⅜″ diameter. This pipe is filed away at *c*, so the drops of oil can be observed. A small funnel-shaped tube, *d*, is set in the top of pipe *b*; at *g* the pipe *b*, funnel *d*, and body *a* are sweat together with soft solder. A bent piece of wire, *e*, has the proper amount of yarn attached to its lower end, which passes over the top of *d*, and down into the oil *f*.

In starting, it is necessary to adjust the yarn (I use German white knitting yarn) putting on more or less strands, according to the feed desired. One strand I find will feed about one drop per minute. It delivers the oil pure, with no chance of stopping up, as is the case with most sight-feed oilers. There is nothing, so far as I know, to hinder any one from using this oiler.

W. M. LINNETT.

Steel Castings.

Editor American Machinist:

On the subject of steel castings, I have after several experiments, proven to my satisfaction that with the steel (old car springs) I have been using in making castings (railroad work of all kinds) any of the castings over 35 or 40 pounds weight, and not less than 1½ inches thick, the castings would be soft, while all the smaller work would be white and hard; all of them poured from the same mixture. My theory as to the differences in the castings is that the heavier pieces retain sufficient heat after pouring and setting to anneal themselves, on which subject I would like some information if wrong. I have taken some of the smaller castings, thrown them into the brass furnace, letting them remain over night, and when taken out in the morning they were found soft. I used no charcoal, but the coke remaining in furnace after last heat in the evening. I have been informed by several experienced men that this would do no good, lack of carbon, etc., as when the castings cooled off again they would be as hard as ever if not harder. As I do not want to place myself in opposition to science, theory and experience, will some one tell me why the castings come out of coke fire soft; they were white and very hard when put in?

Mr. Robert E. Masters, in his communication to your journal of August 15th, seems to think annealing would be required for car wheels so as to enable the hubs to be bored. I am confident such would not be the case if pitted as the regular chill wheel is now, and I further believe that if all the work was shaken out while red hot, put in a pile and covered with dry sand or ashes to keep out the air (or put in a pit) that the mass would have sufficient heat to anneal the whole.

That the temper of sand and facing used exert considerable influence on the quality of the castings, I know to be a fact. I had two center plates made 108 lbs. each. For one mould the sand was damp; used sea coal facing, and double X mineral for dusting and sleeking. The fins on this casting were hard. On the other mould we used sand as dry as safety would permit, no facing used; dusted some plumbago over mould and sleeked down. The fins on this casting were soft. Both were poured from the same ladle, a 300-lb. one; there was a marked difference in the gates when broken. In my mixtures I have used from 10 lbs. to 25 lbs. cast iron to 100 lbs. steel, and with the steel I have been using, I find that 16 lbs. cast iron, soft, to 100 lbs. of steel gives the best results. What we want and must get is, to be able by the ordinary methods now in use of moulding and melting to produce a casting relatively as strong in the castings as it was in the material before melting; in fact, to be able to take casting from mould to anvil without any intermediate process of annealing. Will some one get up a cupola by which we can melt without contact with the fuel? Such a cupola, I believe, would fill the bill. I hope the agitation will be kept up, and give us all a chance to learn without having to pay $5,000 for it.

FRANK KAVANAUGH.

How They Remove Locomotive Tires in Holland.

Editor American Machinist:

One of your correspondents wishes to know of an arrangement for heating locomotive tires to remove them. Making very often much use of the information from correspondents and practical men, given in your valuable paper, in exchange I will try to explain our practice which we often use, and always with success.

I have running from our main gas pipe to the place in our shop where we always repair our locomotive and car wheels, direct under the swing of the crane, a 1¾″ gas tube down to within six inches of the floor, then a circular tube lying horizontally, the inside diameter 4″ larger than the outside diameter of the tire, which must be removed. This tube, which is stopped on one end with a plug, has drilled on the inside one row of holes $\frac{3}{16}$″ diameter, 2″ distance between holes.

Within the circle formed by the tube we place the axle perpendicularly, the wheel, of course, lying horizontally, and after opening the cock, we light the gas, which is pouring out the holes in tube, and heat the tire very equally. Usually the tire needs heating about half an hour, and needs no care.

The wheel is placed upon the blocks, holding the tire free from the ground. When hot the tire drops off, or is helped with a sledge, after which the wheel with axle is hoisted by the crane, and removed.

P. HOVIG,

Chief Engineer of Messrs. A. & D. Volker.

Steenenkamer, near Dordrecht, Holland.

What is an M. E.?

Editor American Machinist:

Having long been an admirer of the AMERICAN MACHINIST on account of the excellent work it has been doing as an educator of American mechanics and mechanical engineers, it is with regret that I notice in an editorial in its issue dated September 5th, what I conceive to be an erroneous view concerning the meaning of the letters M. E. when placed after a man's name, and the right of any person to place them after his name. The editorial in question conveys the impression that these letters mean simply that the man is a mechanical engineer, or that he practices mechanical engineering for a living; that they are a descriptive title of the same kind as the words "machinist" and "boiler maker," and that they may righly be used by any one who considers himself a mechanical engineer.

Will you allow me to enter a protest against this view, and to state my own opinion, which is: 1st. That the letters M. E. mean not that the man *is* a mechanical engineer by virtue of his having actually labored as such, but that he possesses a diploma conferring the degree of mechanical engineer, which diploma has been conferred upon him by a college having authority by law to confer such a degree. 2d. That no other person has any legal or moral right to use them. 3d. That while there may be no penalty attached by law to the wrongful use of these letters, such as there is in many States to the wrongful use of the letters M. D. (which mean that the user of them is the possessor of a college diploma conferring the degree of Doctor of Medicine) the man who uses them and who is not the possessor of a legally conferred diploma which entitles him to use them, is guilty of a willful deception of the public. It is possible that some who wrongfully use these letters are not guilty of willful deception since they are actually ignorant of their meaning, but they at least lay themselves open to the suspicion of willful deception, and if honorable men they will no longer use them after they become aware that such use renders them liable to such suspicion.

That the letters M. E. do not mean that the user of them is entitled to any special eminence as a mechanical engineer, gained by years of labor or great achievement is evidenced by the fact that not one of the eminent American engineers whose long experience and high reputation entitle them to the front rank as mechanical engineers, now uses these letters, or ever has done so. The late A. L. Holley, who was pre-eminently a mechanical engineer, used C. E. after his name, but never M. E. John Ericsson, Horatio Allen, Charles T. Porter, Charles E. Emery, A. H. Emery, R. H. Thurston, Charles B. Richards, John E. Sweet, E. D. Leavitt, Jr., and many other eminent engineers who might be named, never used the letters M. E., not having had the college diploma legally entitling them to use them, and they would scorn to do so without such legal right. Some of these, however, use the C. E. or the Ph. D., to which they are rightfully entitled by diploma, although they do not now practice civil engineering or that class of scientific research for which the degree of Ph. D. is granted.

Still further, the letters M. E. are (with possible rare exceptions) rightly used at the present time only by the younger men in the profession of mechanical engineering, and their use actually advertises the fact that the users are of comparatively limited practical experience, because they are young men. This results from the fact that it is but little over ten years since the degree of M. E. was

first granted. The large majority of M. E.'s of the present time have not been graduated from college over five years.

The AMERICAN MACHINIST has frequently had sneers at college graduates. I am not prepared to say that some of them are not deserved. The fresh college graduate with the M. E. degree is apt to know very little of actual practice; but, as Prof. Thurston over ten years ago said to a graduating class, the college course well fits them *to begin to learn to become* mechanical engineers. Many of such graduates I know, who, after receiving their diplomas, aware that the diplomas did not confer the advantages which only practice could give, went into apprenticeship in machine shops and iron works, working like laborers, at first on wages from fifty cents to a dollar a day. Who shall say that these men, after five years of actual practice, are not likely to be the equals as mechanical engineers of men of the same experience who have not had the advantage of a college training? Three such men I have in mind, who thus began at the bottom in 1876. They have been advanced by their own merits from one position to another, till they now have hundreds of men under their control. Two of them are superintendents of motive power of prominent railroads, and the other is superintendent of large steel works. Are there any mechanical engineers in the country who are not college graduates who have advanced so rapidly during the last ten years?

I have no objection, Messrs. Editors, to some of your correspondents continuing to sneer at college graduates. It will do the graduates good. They cannot have it too severely rubbed into them how ignorant they are of practice. It may teach them a proper humility which some of them are sadly in need of. But, say a good word for them occasionally in your editorial columns, and thereby acquire for yourselves a reputation for fairness. Laugh at them, if you will, for sporting the cabalistic letters M. E. These letters are only a little bit of plumage, which the new-fledged bird is apt to be rather proud of, but, in the spirit of justice, at least, do try to discourage a certain class who are not eminent engineers, and never will be, from borrowing or stealing this plumage, and thereby making themselves contemptible. "Fine feathers don't make fine birds;" the M. E. don't make a mechanical engineer. The strutting peacock and the newly fledged M. E. may both be objects of ridicule, but the crow that steals the peacock's feathers, and the mechanical engineer who steals the M. E. that he has no right to, can only be objects of contempt.

WILLIAM KENT.

26 Highland ave., Jersey City, N. J.

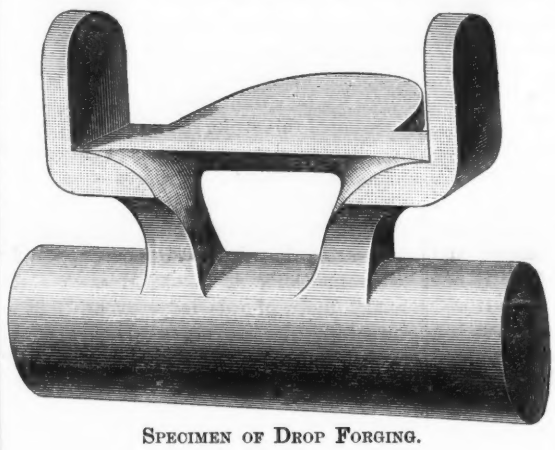
The following, which we take from the *Mechanical World*, contains some very sensible advice, that is universally applicable:

The dispute in the Engine Works Department of Sir W. G. Armstrong, Mitchell & Company's Elswick Works, is assuming a very threatening aspect, and indications of a pending eruption are developing every day. The cause of the dispute is the introduction of a new method of keeping the piece-work, and one which the men suspect to be but the prelude to a general reduction of wages. A large number of those employed in the Ordnance Works have now joined issue with the disaffected ones, and only the discreet and circumspect behavior of both parties can avert a general strike. Should this extreme course be resorted to, it will be regretable in the extreme, for these works are the only ones in that district which are in full and constant employment. We would earnestly counsel moderation as the policy most favorable to a speedy and at the same time lasting settlement. If new managers must introduce new methods, let them do so with a wise discretion, and not attempt to thrust them down the throats of their workmen as if they were a necessary and well-deserved purgative; while if workmen are called upon to adopt new methods, let them at least give the newest departure their calm consideration, and, if possible, a patient trial too. Changes are always looked upon with suspicion by those who are called upon to submit to them, although they may perhaps really contain a blessing in disguise for both parties. We hope that it may not be necessary to resort to extreme measures, either in this case or any other, for they are scarcely less brutal than war itself.

Drop Forging.

The engraving presented herewith gives a good idea of the complicated forms which can be made in the drop press. Drop forging is yet in its infancy; yet, like electric lighting and other new industries, the infant promises to become a lusty man.

Undoubtedly, forging by pressure (and more especially in working steel) is to be the method of the future, and drop forging may be considered an approximation to it.



SPECIMEN OF DROP FORGING.

To say nothing of the advantages arising from drop forgings being duplicates, we have a most important point in their favor in the freedom of these forgings from local strains. The heat is equal in all points of a piece of steel when struck by the press. We are not hammering cold steel in one place, while two inches further we have got a nice red heat.

If a man hammers steel (or iron either) upon an anvil, he gets it completely full of strains. Some places are compressed, some are stretched, and they are at all times trying to equalize themselves. By heating after forging by hand, many of these local strains relieve themselves, but we cannot get rid of them altogether.

For making standard gauges, drop forgings are found to be better than castings, which often need to be straightened with the hammer, thus giving a strain to one part, which will always be changing the shape of the gauge as it seeks to free itself.

This forging is made from a piece of steel $2\frac{1}{4}''$ wide, $1''$ thick and $2''$ long. It is first "broken" between a pair of cast-iron dies, then receives its finished shape from a pair of dies, steel, and hand-cut.

All the hand work is in turning up the two upright ears or lugs. The central lug, which appears fore-shortened in the engraving, is about $1\frac{1}{4}''$ deep, and of equal thickness. By a most ingenious arrangement of the dies, this lip or lug can be made of any thickness desired, or it can be made thick at its outer end and thin where it joins the rest of the forging. In a casting this could not easily be done without complicating the process.

The great drawback of drop forging lies in the great cost of the dies, and right here is a good field for our inventors who have (not) made a fortune in patent car-couplers and anti-rattling connections for carriage shafts.

A process of making dies direct from a pattern will be worth a fortune to its inventor, and will enable us to make drop forgings when only a small number are required.

The forging, which we illustrate above, is part of a bicycle. It is a fine piece of work, and does credit to its makers, J. H. Williams & Co., corner Richards and Bowne streets, Brooklyn, N. Y.

It may not be true that exhibitors at the New Orleans Exhibition who received gold and silver medals are invited to pay for them. We have somewhere seen it so stated.

Laying Out Sheet Iron and Boiler Work.

BY GEORGE MARSHALL.

THIRD PAPER.

THE STEAM DOME.

This follows the cone in the regular order of progression. Ascertain first, how much of your dome is to be cut away in order to conform to shape of shell; this is done by striking a segment of a circle equal to the shell of boiler. Erect a perpendicular from center, then measure off on each side of perpendicular one half diameter of dome. Draw a line from points of intersection as shown in Fig. 5, and the height of arc *C D* equals the piece to be cut out. Allowing for flange, select the sheet to be used, and proceed as in the case of an ordinary cylinder, but dividing the circumference into eight (8) equal parts. Having measured off the height of dome from center of top holes to point *D*, next draw a line representing the height at sides *A B*, Fig. 5, then get a line exactly between these two, as *E*, Fig. 6.

Then on lines 1, 1, Fig. 2, set compass or trammels to strike part of circle required to

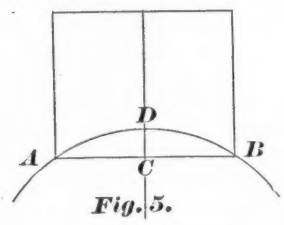


Fig. 5.

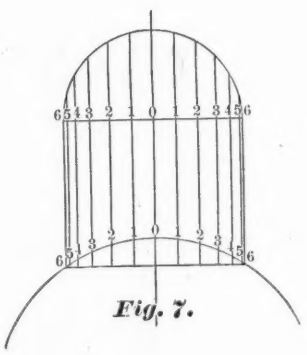


Fig. 7.

intersect at lines 1, 2 *E* and 8, 9 *E* as shown. On line 5, set trammels without changing and strike part of circle as shown on lines 4, 5, 6, *C*, and *E*, Fig. 6. Reverse trammels to opposite side, strike circles as shown on Fig. 6, then draw flange line, divide on ends and side for rivet holes, and the figure is complete.

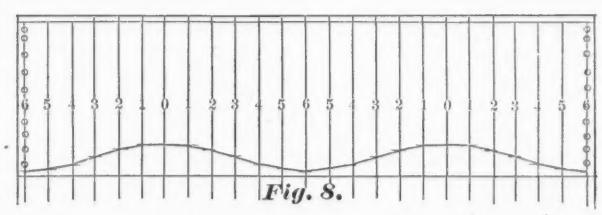


Fig. 8.

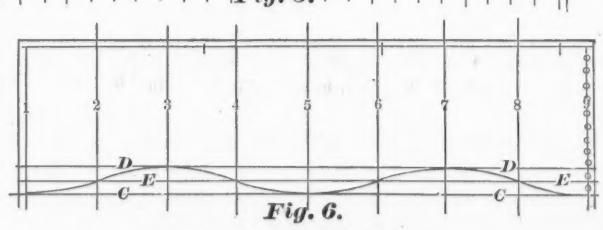


Fig. 6.

LAYING OUT BOILER WORK.

This method, commonly used in nearly all boiler shops, only applies when there is considerable difference between the diameters of dome and boiler, but will not give accurate results when the diameters are equal or nearly so. The only correct and proper method for this kind of work is by lines drawn on the straight sheet to represent them if drawn on the circular piece; and as the line system applies to very many of the pieces usually laid out by boiler makers, their study is earnestly recommended. In laying out a dome by lines, a sketch of boiler and dome is required the same as in Fig. 5; in addition, a half circle is drawn on top of dome equal to one-half the diameter of dome rolled up; this is divided into as many equal parts as may be desired, and the lines carried down to intersect with shell, as shown in Fig. 7. These lines may be marked by letters or numbers.

In preparing the straight sheet from which it is proposed to construct the dome, having calculated the circumference and measured off the same, divide the distance into twice the number of spaces shown on half circle, and carry the lines straight across the width of sheet; then set compass or trammels at 1 1 Fig. 7, transfer these distances to same numbers on Fig. 8; follow same proceeding with all the other numbers and you can rely on having a well-fitting dome, if your flanger keep the same to a true circle in the turning of flange.

It will be noticed that there are five numbers 1, 2, 3, 4 and 5, and but two numbers 6 and 0; the necessity for this is apparent, when it is understood that only one-half the circumference of dome is seen in Fig. 7, and the full circumference in Fig. 8. It also follows that the points 1, 1, 2, 2, &c., are identical with those on opposite side; hence the distances when transferred must be to all of the points with like numbers. Domes laid out by this method can be placed on the center or side of boiler, or the dome, and boiler may be of same diameter and accurate results will follow.

This method also applies to laying-out of connections between boilers, or a nozzle to connect a horizontal dome with a shell; in fact the line system, if applied correctly, will apply to almost any figure, but requires slight modifications to suit each case. In future numbers I will show the application of this principle to other figures than the plain cylinder.

In these sketches the seam has been placed on long side of dome, as is the custom. There are cases where a departure from this custom is necessary; a careful study of the rule governing this class of work will enable any one to place the seam at whatever point is desired.

In laying-out cylinder work, whether domes or shells, it is recommended that the circumference be divided into four equal parts and a hole punched on the quarter; then when laying-out a head, square the same and center at flange line the four points. In fitting up work this will be found valuable, as holes can be punched in flange at indicated points, and the head can be fitted in and marked off with very little trouble.

In 1860, the wood industries employed 130,000 persons; to-day they employ 340,000, while the value of their annual product has trebled. The woolen industry employed 60,000 persons then, and now employs 160,000, while our home mills, which produced goods of the value of $80,000,000 in 1860, now turn out an annual product worth $270,000,000.

The iron product amounted to 900,000 tons of ore; to-day it foots up over 8,000,000 tons a year, almost a nine-fold increase.

The silk industry employed 5,000 persons; now it employs about 35,000, seven times as many.—*Commercial List.*

The disadvantages of appointing men to duties they know nothing about is exemplified in the commission for devising means of putting electric wires under ground in New York City. They seem to be especially engaged in listening to arguments showing that the wires should be kept above ground.

The largest locomotive item is getting monotonous. It is being built in several places at the same time.

Adjusting compasses in iron ships is said to be done by only three persons in the United States.

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NEW YORK, SEPTEMBER 19, 1885.

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Business Improvement.

There is at the present writing every evidence of business improvement. Machinery business is never the first to feel the reaction after dull times, hence improvement is scarcely, in many instances not at all, felt in this branch. But it is clearly seen in textile and other industries, and has been felt long enough to warrant the assumption that it is not a mere spasmodic effect. It is impossible that business shall materially improve in a few of its branches without affecting the other branches. The gain will undoubtedly be slow, so slow as not to be noticeable from week to week. No one will be wise who expects a boom this fall or winter, but unless all ordinary signs fail, an era of better times has begun. The period of depression has taught men caution, so haply the rush of business beyond the bounds of any hopes of permanency is not under any circumstances probable. It will be infinitely better for the country that the increase be slow and sure than that it come with a rush to leave a calm behind it. But while cautious, it is plainly evident that there is everywhere increased confidence, which of itself will have a good effect in helping to restore business to a healthy condition. In the iron business we note that in some instances the wages of workmen have been increased, and that in this as in nearly all other lines the inclination towards further reduction has almost or entirely ceased. This is a most encouraging sign, as with better wages, or reasonable evidence that further reductions are not impending, the great army of workingmen, whose ability and willingness to purchase has a greater influence on general business than any other single condition, will buy more freely, and so assist in removing the brakes from the wheels of trade. There are in the iron-trade industries more inquirers; there is a fair prospect for business in steel rails, and most of the pipe mills are busy. Last, but of the first importance, the promise of good crops insures such a distribution of money as will spread the means of purchasing over all parts of the country. Let everyone take heart from the encouraging signs; if everyone goes to work as if the worst was over, we trust and believe that it will be found to be so.

One Young Lady's Way of Making Herself Independent.

The question: What can a woman do? is one that is often raised. Quite generally it is assumed that she lacks certain qualities, such as self-reliance and tenacity of purpose, and that this lack disqualifies her for positions that she is physically competent to fill. This may be true in some instances, but it is not always true. As substantiating this we publish the following incidents in the career of Miss Ida M. Black, of Keokuk, Iowa. It is due Miss Black to state that we do this without her knowledge; we trust she will pardon us for doing so, which we are led to believe she will do from the fact that she is a regular reader of the AMERICAN MACHINIST:

Miss Black was left an orphan at the age of twelve, and realized that for her future support she must depend mainly upon her own exertions. With some assistance from friends she learned telegraphy, and at the age of sixteen was recognized as a first-class operator. About this time she was left one evening in charge of the office in which she had learned telegraphy to report trains from the junction of the Wabash, St. Louis and Pacific, and the Chicago, Rock Island and Pacific Railroads, going in and coming out of Keokuk by Buena Vista Junction, three miles from Keokuk. A terrific storm came on, and the regular operator who it was supposed would be there did not make his appearance. The train dispatcher at Keokuk, knowing she had been left alone at the junction, and naturally expecting she would be frightened by the warring elements, frequently called to her over the wires, always receiving the assurance that she was there, and should stay. And she did stay, and reported every train with the lightning flashing from the keys and switch-board in a way calculated to upset the nerves of a strong man, to say nothing of those of a weak young girl.

Soon after this Miss Black was appointed station agent and operator at Sand Prairie, Iowa, which place she held for two years, resigning to accept a position as bookkeeper in a manufacturing establishment in Keokuk. At the expiration of one year's service as bookkeeper she received an appointment to the Western Union Telegraph Office at Lake Bluff, a short distance from Chicago. She gave up her position as bookkeeper the day before the telegraph operators' strike in 1883. Learning of this strike she wrote the manager a polite note, declining to accept the position at Lake Bluff until the strike was settled.

Miss Black has just passed her twenty-first birthday, and since May, 1884, has been manager of the Western Union Commercial Telegraph Office at Beloit, Wis. We need not say more of this lady, except that her success in life has *not* made her strong-minded in the offensive sense in which this word is used, as all who meet her will testify to.

Look to the Oil.

We have recently heard more than the usual number of complaints against the quality of lubricating oil. In one instance, only a few days ago, we were informed by an engineer in charge of a 200 horse-power engine that he found his coal consumption increasing, and applying the indicator to his engine he found the indicated power to be 23 horse-power greater than ever before. He remembered that through the representations of a dealer in oils—a traveling salesman—the proprietor had made a change a few weeks before, buying at six cents a gallon cheaper. Upon carefully calculating the quantity of oil used it was found that the new oil was actually costing ten per cent. more than the old, more of it being used. In addition to this the coal bill was increased by about $1.50 per day. The damage to machinery the engineer did not attempt to estimate. A change back to the old oil brought about, in a few days, the old order of things.

In another instance the cylinder oil, a kind that had been used with entire satisfaction for four years, was changed. In less than two months it was necessary to reface the valves and seats, which were badly cut; this was done at an expense, including loss from stopping the works, several times greater than the cost of all the cylinder oil used for a year.

The moral seems to be that, when an oil is in use that gives good satisfaction it is generally poor policy to make a change. The saving of a dollar or two on a barrel of oil is seen at once, hence the constant temptation to change to the cheaper quality; very frequently if the quantities used were taken into account, the cheaper in price would be seen to cost the most. If in addition to this, the increase in power required to drive the machinery, and the loss from wear and tear were correctly estimated, it would not take long to come to the conclusion that it was better to pay well for good oil than to take that of a poor quality as a gift.

We publish elsewhere a communication from William Kent on the use of the title M. E. Mr. Kent is a mechanical engineer who has earned the right to be considered such by his work outside of a school; he is also a technical-school graduate. While he does not use M. E. after his name he is a strong advocate of what he believes to be the exclusive right of school graduates to the title. Whether he is right or not is one of the things not likely ever to be settled by argument.

There is one item of information in this communication covering a point upon which we are glad to be informed; that is that the letters M. E. may be rightly used only by those with little or no practice in actual mechanical engineering. We do not believe it is generally so understood, but if it comes to be the practice it may be just as well. If it is known that the letters mean that their user is *not* in any important sense a mechanical engineer they will cease to be confusing.

The superintendents of coal mines in Pennsylvania have notified boys less than fourteen years of age that under the provisions of the new law they must quit work and attend school for a few weeks. Already the complaint goes out that this new order of things will work hardship to families dependent upon the labor of children for support. The fault is not with the law, which is a very proper one, but with the conditions that will not permit children under fourteen to be withdrawn from the grinding work of a coal mine for three months out of the twelve. Another law quite as much needed is one prohibiting the employment of children of seven or eight years of age in mines.

Is England a country of short hours for workingmen? We are moved to this inquiry by reading that the largest street railroad company in England work their employes sixteen hours per day, Sundays included.

Literary Notes.

PLUMBING PROBLEMS; or, QUESTIONS ANswers and Descriptions Relating to House-Drainage and Plumbing. From the *Sanitary Engineer*. With 146 illustrations. New York: the *Sanitary Engineer*.

The *Sanitary Engineer* is a recognized authority in its special lines, and this work is, in the main, made up of matter selected from its columns. It is largely composed of questions which have from time to time been submitted to the editor, with his replies. There is no subject of more importance to householders than their arrangement of plumbing and house drainage, and everyone should so far master the problems connected with them as to be able to detect at least the grosser forms of misarrangement. This, it it seems to us, a perusal of this work will lead to, as it is written so plainly, and so fully illustrated, that the meaning cannot be misunderstood, while the range of subjects covered is very full, including complete plans of hot-water circulation. To the engineer the book will be found valuable, containing, as it does, matter not to be found in other works, and an appendix made up of plumbing specifications, etc. It can be had from the *Sanitary Engineer*, 140 William street. Price, $2.

GAS ENGINES. By William MacGregor. With Seven Plates. D. Van Nostrand, Publisher, 23 Murray street, and 27 Warren street, New York.

In this work the author supplies the demand for information that has heretofore not been easily obtainable, if at all. In the first pages early attempts in the direction of the construction and operation of gas engines are detailed, followed by later examples, the whole representing the progress that has been made in this important field of design and manufacture. Engines working with and without compression are compared. The theory of the gas engine is explained, the speed of combustion, effects of different mixtures, economical performance of engines given, together with a large amount of other information of practical value to the engineer, mechanic and manufacturer. The concluding chapter relates to the gas engine indicator diagram. Altogether, considering the almost entire lack of literature on this subject, the author and publisher are to be congratulated and commended for bringing out this volume, which, we have no doubt, will be well received. The price of the book is $3.

BALLOONING. A Concise Sketch of its History and Principles, from the Best Sources, Continental and English. By C. May. D. Van Nostrand, Publisher, 23 Murray street, and 27 Warren street New York.

Considering the fact that there is at the present time renewed interest in the use of the balloon, the appearance of this volume seems to be timely. In it the author gives an historical account of aerial navigation, going back to the earliest times of ballooning, and coming up to the present. The obstacles in the way of the practical use of the balloon are considered, and the means

by which they may be surmounted. Various applications of ballooning are treated—the steering power, propelling power, air currents, etc., etc. The latest inventions proposed for solving the problem of controlled motion in a balloon are set forth, and illustrations of balloons given. Aside from its scientific and technical value, which are undoubted, the book is a very readable one. The price is $1.

The Miller, of Chicago, is a new monthly of which vol. 1, No. 3 is before us. It is intended to represent the interest of burr millers as opposed to the new roller mill system of grinding. It is a neatly printed paper, and is conducted in lively style.

The Black Diamond is a new journal just started in Chicago to represent the coal trade. The first number promises well.

In a recent English steam-engine invention the air pump, connected by return crank to the crank disk, is arranged so that steam can be admitted to it to help the engine off the center in starting.

"When we must design a special machine, we want to visit the place where said machine is to be used. We want to see the surroundings that machine is to have. We want to see the men who are to run it, and the material it is to utilize. If a man comes to us and says, 'I want to do such and such work in that town; I have got this material to work up, and I want a machine to do it well and economically,' then we tell that man we can't give him satisfaction until we have visited the exact locality, and have studied thoroughly the whole situation. Then we can do the matter justice." So said a machinery man in our hearing.

According to Superintendent Shannahan there was carried over the canals of New York in one week in August, 2,177,000 bushels of grain, while during the same week the railroads carried only 148,000 bushels. Yet we notice that there are people who believe the canals are of no use.

Last week we published a suggestion of a correspondent for flattening a spot on twist drills near the end of the shank and marking the size there, so it would not be obliterated the first time the drill slips in the chuck. Another correspondent writes us, asking why manufacturers of twist drills do not mark the size just where the twist terminates and the shank begins, where it would not be defaced by the jaws of the chuck. We respectfully refer the matter to the makers.

We infer from the following, which we take from the *Railway Review* (England) that trains are not always run in Britain as close on time as we are sometimes led to suppose:

When a train is booked to arrive at a certain point at half-past two, it doesn't improve the temper of those who travel by it to find it reaches its destination three-quarters of an hour after the advertised time. That this is not an uncommon occurrence on the Great Western Railway system, others besides myself can testify.

Does this account for the fast time we read so much of on English roads?

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials, nor location will be published.

(263) Engineer, Hoboken, N. J., asks: 1. What is the best and quickest way to cool a pump when it gets hot and will not work? *A.*—We have never found a quicker way than to deluge it with cold water. 2. What can you do to stop boiler tubes leaking at the tube-sheet? *A.*—Have a boiler-maker reset the ends.

(264) D. R., Central City, Col., asks: 1. Is water a compressible fluid? *A.*—Water, for all practical purposes, may be considered incompressible. 2. Is the pressure of steam greater in a locomotive boiler at the back end than at the front end? *A.*—No. 3. Will an injector feed a boiler with less steam pressure at the front end of a locomotive boiler than at the back end? *A.*—No; not if the distance of feed below the surface is the same. 4. Which is the best stationary boiler, the one with a dome, or the one with an inside pipe? *A.*—Opinions differ. If properly constructed, probably one is about as good as the other.

(265) A. P. B., Columbus, Ohio, asks: Is it proper to oil the teeth of gear wheels? *A.*—It is a good plan to use a little oil on small wheels. Heavy gearing may advantageously have tallow applied to the teeth occasionally. 2. When a belt will not run true on pulleys, and the pulleys are in line, would cutting the belt a little out of square help it? *A.*—It might, probably, afford temporary relief, but the proper plan is to find why the belt will not run properly when laced square, and to remedy the difficulty. If the belt is laced true, the belt will run to one side if the pulleys are not turned true, or if the two shafts are not in line both ways, one with the other. A careful examination will probably show one or the other of these faults. You might try changing the belt end for end. 3. Is it good policy to wet the ashes in the ash pit of a portable engine before drawing them? *A.*—We do not believe it is a good plan to wet the ashes in any boiler where the water will come in contact with the metal. Dampness in the corners and seams is likely to start corrosion.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Patents. Fees, $10 up. Write Hill & Co., 165 B'way, NY

Curtis Pressure Regulator and St'm Trap, Aug15, p 12

J. Clayton, Air Compressors, Rock Drills 43 Dey st, NY

Edw. Sears, wood engraver, 48 Beekman st., N.Y.

Presses & Dies, Ferracute Mach. Co, Bridgeton, N.J.

Steel Name Stamps, &c. J.B. Roney, Lynn, Mass.

Tack, wire, and shoe nail machinery; Wm. A. Sweetzer, Brockton, Mass.

Treatise on gear teeth and bevel gears; specimen pp free. Geo B. Grant, 66 Beverly st., Boston, Mass

Consulting Engineer and Mechanical Expert, C. C. Hill, 84 Market st., Chicago, Ill.

The Best Upright Hammers run by belt are made by W. P. Duncan & Co., Bellefonte, Pa.

R. Dudgeon, 24 Columbia st, New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts., New York.

"How to Keep Boilers Clean." A book mailed free, by James E. Hotchkiss, 86 John st., N. Y.

Improved Labor-Saving Upright Drills: prices reasonable. Currier & Snyder, Worcester, Mass.

The latest Improved Tack and Match Machinery is made by White Machine Co., Waterbury, Conn.

Foot-Power Machinery for workshop use, sent on trial if desired. W. F. & Jno. Barnes, Rockford, Ill.

Lyman's Gear Chart. How to lay out gear teeth. Price, 50c. E. Lyman, C. E., New Haven, Conn.

Lathe tools, improved threading tools, cutting-off tools. Catalogue sent. H'tf'd Tool Co., Hartford, Ct.

Machines to form and bend steel and iron; run by power. Williams, White & Co., Moline, Ill.

Send ten cents for 98-page catalogue of scientific books. D. Van Nostrand, 23 Murray st., N. Y.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocum & Son's Shafting Works, Drinker st., Philadelphia, Pa.

Engine Lathes, Hand Lathes, and other fine tools. Assortment large; prices low. Frasse & Co., 62 Chatham st., N. Y.

Farley's Reference Directory of the Machinists', Iron, Steel and Metal-Working trades of the United States. A. C. Farley & Co., Philadelphia, Pa.

Files recut without drawing temper, about one-half usual prices; samples recut free; prices on application. The Acme Co, Collinsville, Conn.

The outline ("wax process") engravings shown in the AM. MACHINIST each week are made by Struthers, Servoss & Co., 24 to 34 New Chambers St., N.Y.

"Complete Practical Machinist," $2.50; "Mechanical Drawing Self-Taught;" $4. Books for workmen. Joshua Rose, Box 3306, New York City.

Patent Bolt Dogs, as illustrated in AM. MACHINIST of Sept. 5, sent prepaid anywhere in the U. S. upon receipt of $2.25. Fay & Scott, Dexter, Maine.

Morrison's Practical Engineer, a complete treatise on steam and general machinery, sent free on receipt of price, $1. Indicators, Engineers' Instruments and outfits. W. A. Morrison, Box 373, Lowell, Mass.

D. H. McAlpin & Co., N Y., the large tobacco manufacturers, say: "Hine & Robertson, 12 Cortlandt street, N. Y.—The Kellam Pressure Regulator attached to our steam system works very satisfactorily, and carries out all that was claimed for it."

Locomotive Engine Running and Management. By Angus Sinclair. Gives full directions about handling and repairing locomotives; instructs how to design valve gear and set valves; Westinghouse air brake explained by aid of engravings. Price, $2. For sale by *National Car Builder*, 187 Dearborn st., Chicago, Ill.

Every young man who aspires to be either a mechanic, merchant, or manufacturer, owes it to himself that he become thoroughly familiar with the writings of Chordal. John Wiley & Sons, 15 Astor Place, N. Y., have issued a new and enlarged 12 mo edition of "Extracts from Chordal's Letters." Handsomely bound in cloth, with over 50 illustrations. Price, $2. Discount of 25 per cent. on orders for five or more copies.

MANUFACTURES.

The D. L. & W. Railroad will erect a new round house.

Stephen Monsen will rebuild his foundry at North Albany, N. Y.

W. F. Meader & Co. are to build an elevator at Gibbon, Minn.

Allen & Kail will build a 50-barrel flour mill at Alfondsville, Ind.

Withgott & Dillahay will establish a machine shop at Easton, Md.

The Standard Silk Company are to erect a new mill at Phillipsburg, N. J.

W. U. Mattox and others, of La Grange, Ga., are to erect a cotton seed oil mill.

An iron bridge is to be built across the Susquehanna river at Williamsport, Pa.

Houston & Mills, of Akron, Ohio, contemplate erecting a foundry and machine shop at Dayton, Tenn.

John Wood, of Conshohocken, Pa., is converting the old car works at that place into a machine shop.

Wm. G. Selleck, Englewood, N. J., will build a $10,000 extension to the factory at 61 Ann street, New York.

Truxel & Dunnemeyer, machinists, Chattanooga, Tenn., will make an addition to their building to cost $12,000.

J. J. Craig will erect a building to be used as a lumber and marble mill at Knoxville, Tenn, at a cost of $100,000.

The Waterloo & Seneca Falls Railroad Co., will erect a building to be used as a roundhouse at Seneca Falls, New York.

Schoenberger & Co., Pittsburgh, Pa., will erect a large regenerator at their steel works, which will be run by natural gas.

The Chattanooga Ice Co., of Chattanooga, Tenn., will make repairs to their machinery and factory to the amount of $11,000.

Fichter & Martin, Allentown, Pa., will fit up an additional room, 120x40, with looms, etc., for the manufacture of silk ribbons.

Currier & Joy, Ellsworth, Maine, are completing more commodious buildings in which to prosecute their wood-working business.

The Eagle Manufacturing Co, Kansas City, Mo., will erect a five-story brick building to be used for manufacturing purposes. Estimated cost, $17,000.

All the cotton mills at Woodbury, Md., started on full time on or about the first of September. Some of them have been idle, and others running short time.

Walter S. Johns, 8 Noel Block, Nashville, Tenn., proposes starting a factory for the manufacture of machines for the cleaning and grading of peanuts and pecan nuts.

The roundhouse and repair shops of the Providence & Springfield Railroad, at Providence, R. I., are to be rebuilt by the company as soon as the insurance is adjusted.

Wilson, Walker & Co., of Pittsburgh, Pa., will at once commence the erection of an iron foundry to be connected with the coal mine supply department of their present mills.

The Reading Foundry & Machine Co, of Reading, Pa., will erect a new pipe foundry, engine-house and office. The foundry will be 76x252 feet in size, and will be built this year.

J. H. Cheever, Treasurer of the New York Belting and Packing Company, is at the head of a new concern that will erect a large cotton bleachery at Passaic, N. J., to employ 260 hands.

McKee, Anderson & Co, Beaver Falls, Pa., will remodel their old sheet mill and put in a special set of rolls for rolling old steel rails into sheet bars. Natural gas will be introduced.

The Matthieson & Weichers Sugar Refining Co., of Jersey City, N. J., has purchased the old Adirondac steel works buildings of that city, with a view to the further extension of their business.

The Hoggson & Pettis Mfg. Co., New Haven, Conn., has purchased all rights in the "Sweetland" chuck, and will go on with their manufacture. The inventor, William L. Sweetland, is superintendent.

Two two-story factory buildings, each 200x80 ft., will be erected on Shunk street, Philadelphia, Pa., to be used as a salt manufactory. Penna. Salt Manufacturing Co., owners, 140 S. Del ave., Phila., Pa.

Wm. A. Sweetser, late of the firm of Sweetzer & Merritt, Brockton, Mass., has bought out the Brockton Machine Co., of that city, and will manufacture a full line of tack, wire and shoe-nail machinery.

The Malleable Iron Works, at Canton, Ohio, resumed operations on the 12th inst, after several months' idleness. The works started full in all departments, and expect to run throughout the winter.—*Iron Trade Review.*

The Tabor Manufacturing Co., 111 Liberty street, New York, has issued a new circular of the Tabor steam-engine governor. In addition to dimensions and prices of governors, it contains a discussion of the merits of throttling engines.

The Wichita Water-Power Co. have begun work on the dam at Wichita Falls, Texas, and in a few months they expect to have sufficient power to run any kind of machinery. A woolen and flour mill will probably be erected in a short time.

Reed Bros., tack manufacturers, Brockton, Mass, will erect a large rolling mill near their present factory. It will be fitted up with the latest and most improved machinery for their purpose, and when finished will be one of the largest rolling mills in that section.

An elevator company has been organized in connection with Evans' line of boats on the Missouri, to buy and ship grain at all river landings between Pierre and Bismarck, and elevators will be built this fall at Fairbanks, Libeau, Scranton and La Grace.—*Northwestern Miller.*

A meeting of prominent Rhode Island manufacturers was recently held at Providence, at which a resolution was passed protesting against reopening the tariff agitation at the coming session of Congress. The preamble expressed a belief that business prospects were more hopeful.

A company has been incorporated at Belleville, Ill., with a capital of $30,000, for the manufacture of the Schwartzweidelder wheat-scouring machine. By one or two changes the machine can be made to shell rice. The company are completing their organization, and will erect works.

The two 500 horse-power engines, built by the Watts-Campbell Company, of Newark, N. J., for the elevated wire rope road in Jersey City, have been tested for driving the machinery of the road with entirely satisfactory results. It is expected that the road will soon be in operation.

The Norwich (Conn.) *Bulletin* says that the sales in manufactured goods in Norwich were greater in July than for the corresponding month for five years. Prices are said to be low, but the goods on hand are being rapidly disposed of. The *Bulletin* thinks the chances for improvement in business are good.

The South Tredegar Iron Co., Chattanooga, Tenn., have shipped an eighty-pound package of their steel nails to the Edgar Thompson steel mill as a sample. Several of them were driven into a 3-inch dry oak plank without the least sign of bending or cracking, and were clinched on the other side.—*Age of Steel.*

The Standard Watch Company, of Jersey City, N. J., has broken ground for the erection of buildings for manufacturing watches. Their new movement, called the "screw movement," is said to greatly simplify the mechanism of the watch. The buildings will consist of main building 100x30 feet, four stories high, and an extension 30x30 feet. It is said that 500 hands will be employed. It is expected eventually to manufacture clocks, made on the same principle as the watches.

The Abendroth & Root Mfg. Co., 28 Cliff street, New York, have recently increased their capacity to manufacture their "New Root Boiler" by erecting new tools of special design, and engaging the services of capable engineers to attend to that special branch of their business. They have quite recently made some decided improvement in the method of construction, which improve the appearance as well as add to the efficiency of the boiler. Among the more important improvements are the use of expanded joints in place of numerous cap joints, as formerly; a heavy front of pleasing design, and the housing in of the tube heads. The framework for supporting the heating surface is also done away with, and the whole supported entirely independent of the brickwork, thus positively avoiding all cause for the cracking of the latter. We learn that, when required, each boiler is tested up to 500 pounds hydraulic pressure after erection, and before enclosing in the brick work, and that several are now in operation carrying from 125 to 250 lbs. steam pressure. We expect soon to publish a full description, with illustrations, of the improvements mentioned.

The Cedar Point Iron & Steel Company are building a Clapp-Griffiths converter, to be operated in connection with their blast furnace, this being the first company in this country to adopt the process for use with the blast furnace. At Belleville, Ill., the Belleville Nail Company are building a steel plant to be operated by the Clapp-Griffiths process. The Glasgow Iron Company, of Pottstown, Pa., have increased their capital stock for the purpose of erecting a Clapp-Griffiths steel plant. The Danville Nail Manufacturing Company, of Danville, Pa., have also increased their capital stock to erect a steel plant, which will undoubtedly be operated by the Clapp Griffiths process. The Pottstown Iron Company, at Pottstown, Pa., have erected a building for a steel plant, but the kind of plant to be built has not yet been made public. Representatives of the firm of A. McDonald & Brother, of St. Louis, have been examining the Clapp-Grffiths steel plant at Pittsburgh, with a view of adopting the process. At the Trenton Iron Company's works, at Trenton, N. J., one of Gordon's stationary steel converters is now in course of erection, to be operated upon the pneumatic principle. The plant will be in operation this month. At Birdsboro, Pa., the E. & G. Brooke Iron Company are building a new steel converter to produce steel by the same process.

LETTERS FROM PRACTICAL MEN.

Petroleum Fuel on Steamers.

Editor American Machinist:

You ask how we "get steam in the first place to supply the steam jet mentioned in your description of apparatus for burning petroleum, as published in our issue of August 1st.?"

On our large steamer Solano there are two engines and two sets of boilers; there is always steam in at least one of the boilers, hence we are independent upon this boat, and can fire up at any time. But on the other boat, where there is no steam, when one or more boilers are blown out, we arrange the firebrick on the grate bars next to the door, say for a space of two feet in width, so that they may be removed easily, and we fire up with wood until ten or fifteen pounds of steam has been raised; then the bricks are laid back in place so as to prevent the air passing through the grates; the oil jet is then turned on.

A. J. STEVENS,
General M. M. Southern Pacific Company.

Hints About Shop Tools.

Editor American Machinist:

If machine-shop proprietors would carefully watch the production of their tools, and, as soon as a machine fell behind the best practice of the day, either in amount or quality of work, dispose of or remodel it, their profits would be materially increased. "Kid" had the right idea when he altered his lathe to increase the feed, but his method was not just the best. Now, every time he changes his feed he must change a gear. Had he left the cones on the rod, and added enough to the end to put on a feed gear, he would still have had ready at all times a feed suitable for much work, and a gear feed that could be attached instantly whenever a coarse feed was needed.

A drill press that I remember well had a power feed, but no quick return, which made the production of holes on that press rather a slow matter, as it took a long time to screw the spindle up or down whenever the height of the drill point from the table was not suitable for the job in hand, to say nothing of the time lost in backing out of holes, starting the drill true, etc. The remedy in this case was a new shaft through the worm gear and feed pinion, long enough to admit of putting a friction disk and tightening nut upon one end, and a 16″ hand wheel on the other. A lever and ratchet were also attached to this same shaft, so that in the matter of small and short holes the production of the machine was more than doubled.

This leads me to speak of a communication from "Old Jour," which appeared in your paper about one year ago, stating that power feeds should be removed from all drill presses. He said that it took five minutes to drill a half-inch hole through a piece of cast iron one-half inch thick. At that same time I was drilling one and one-half inch holes in steel castings at the rate of one and one-fourth inch per minute, with power feed, and that, too, with the finest feed on the machine. I don't believe any man, unless on piece-work, would crowd a drill through stock at that rate with hand feed.

I like a good drill press, and I have almost surprised myself at the variety of work that can be done with one, if time and thought are used a little to rig up—milling, surfacing and profiling almost without end. When I get time to make drawings, I will try to show your readers some of the ways in which the drill press has helped me out.

F. S. JOHNSON.

Twisted Arithmetic—The Hog-Nozed Drill.

Editor American Machinist:

Brother Richards in AMERICAN MACHINIST of September 12, makes a touching appeal for help and co-operation in defending our "twisted arithmetic." Now, if it strikes Brother Richards in a tender place, how must it affect our lacerated feelings, which are supposed to be totally devoid of cuticle through the efforts of some of your esteemed correspondents, and one or two contemporaries. We appreciate the situation and detail our old friend "Tom," who, you will remember, was suspended for "using his chalk on his boot leg." Tom is anxiously waiting for Brother Richards to get another piece of chalk. Then Tom will figure up what is left of Mr. Dingley, if he can find him. We really must leave it with Tom, for Brother Goodyear has run over to have a quiet little "root" with the "hog-nose," and as we have had no experience with a drill larger than 2″, and none whatever with a "cannon drill," we will have to fly around and find a bit of soft ground to begin the root in.

JAMES F. HOBART.

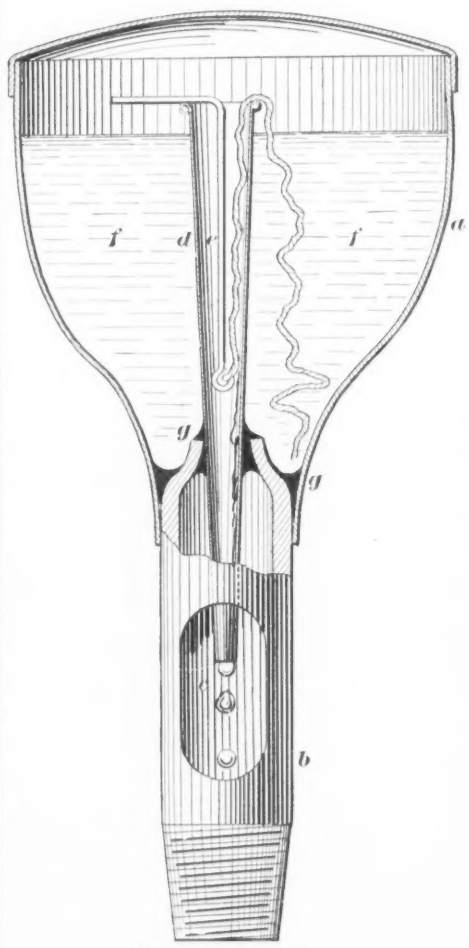
A Simple Sight-Feed Oil Cup.

Editor American Machinist:

I have had such success with the oil cup, shown in sketch, that it prompts me to send it, in hopes that my experience may benefit some one else.

Some three months ago I was obliged to adopt some sort of continuous oiler for electric-light plant, and this one seems to fill the bill, exactly.

Referring to the engraving, from rough sketch, *a* is the body of the oiler, and *b* is a



SIGHT-FEED OIL CUP.

short piece of brass pipe, which may be $\frac{1}{4}$″ or $\frac{3}{8}$″ diameter. This pipe is filed away at *c*, so the drops of oil can be observed. A small funnel-shaped tube, *d*, is set in the top of pipe *b*; at *g* the pipe *b*, funnel *d*, and body *a* are sweat together with soft solder. A bent piece of wire, *e*, has the proper amount of yarn attached to its lower end, which passes over the top of *d*, and down into the oil *f*.

In starting, it is necessary to adjust the yarn (I use German white knitting yarn) putting on more or less strands, according to the feed desired. One strand I find will feed about one drop per minute. It delivers the oil pure, with no chance of stopping up, as is the case with most sight-feed oilers. There is nothing, so far as I know, to hinder any one from using this oiler.

W. M. LINNETT.

Steel Castings.

Editor American Machinist:

On the subject of steel castings, I have after several experiments, proven to my satisfaction that with the steel (old car springs) I have been using in making castings (railroad work of all kinds) any of the castings over 35 or 40 pounds weight, and not less than $1\frac{1}{2}$ inches thick, the castings would be soft, while all the smaller work would be white and hard; all of them poured from the same mixture. My theory as to the differences in the castings is that the heavier pieces retain sufficient heat after pouring and setting to anneal themselves, on which subject I would like some information if wrong. I have taken some of the smaller castings, thrown them into the brass furnace, letting them remain over night, and when taken out in the morning they were found soft. I used no charcoal, but the coke remaining in furnace after last heat in the evening. I have been informed by several experienced men that this would do no good, lack of carbon, etc., as when the castings cooled off again they would be as hard as ever if not harder. As I do not want to place myself in opposition to science, theory and experience, will some one tell me why the castings come out of coke fire soft; they were white and very hard when put in?

Mr. Robert E. Masters, in his communication to your journal of August 15th, seems to think annealing would be required for car wheels so as to enable the hubs to be bored. I am confident such would not be the case if pitted as the regular chill wheel is now, and I further believe that if all the work was shaken out while red hot, put in a pile and covered with dry sand or ashes to keep out the air (or put in a pit) that the mass would have sufficient heat to anneal the whole.

That the temper of sand and facing used exert considerable influence on the quality of the castings, I know to be a fact. I had two center plates made 108 lbs. each. For one mould the sand was damp; used sea coal facing, and double X mineral for dusting and sleeking. The fins on this casting were hard. On the other mould we used sand as dry as safety would permit, no facing used; dusted some plumbago over mould and sleeked down. The fins on this casting were soft. Both were poured from the same ladle, a 300-lb. one; there was a marked difference in the gates when broken. In my mixtures I have used from 10 lbs. to 25 lbs. cast iron to 100 lbs. steel, and with the steel I have been using, I find that 16 lbs. cast iron, soft, to 100 lbs. of steel gives the best results. What we want and must get is, to be able by the ordinary methods now in use of moulding and melting to produce a casting relatively as strong in the castings as it was in the material before melting; in fact, to be able to take casting from mould to anvil without any intermediate process of annealing. Will some one get up a cupola by which we can melt without contact with the fuel? Such a cupola, I believe, would fill the bill. I hope the agitation will be kept up, and give us all a chance to learn without having to pay $5,000 for it.

FRANK KAVANAUGH.

How They Remove Locomotive Tires In Holland.

Editor American Machinist:

One of your correspondents wishes to know of an arrangement for heating locomotive tires to remove them. Making very often much use of the information from correspondents and practical men, given in your valuable paper, in exchange I will try to explain our practice which we often use, and always with success.

I have running from our main gas pipe to the place in our shop where we always repair our locomotive and car wheels, direct under the swing of the crane, a $1\frac{3}{4}$″ gas tube down to within six inches of the floor, then a circular tube lying horizontally, the inside diameter 4″ larger than the outside diameter of the tire, which must be removed. This tube, which is stopped on one end with a plug, has drilled on the inside one row of holes $\frac{3}{16}$″ diameter, 2″ distance between holes.

Within the circle formed by the tube we place the axle perpendicularly, the wheel, of course, lying horizontally, and after opening the cock, we light the gas, which is pouring out the holes in tube, and heat the tire very equally. Usually the tire needs heating about half an hour, and needs no care.

The wheel is placed upon the blocks, holding the tire free from the ground. When hot the tire drops off, or is helped with a sledge, after which the wheel with axle is hoisted by the crane, and removed.

P. HOVIG,
Chief Engineer of Messrs. A. & D. Volker.
Steenenkamer, near Dordrecht, Holland.

What is an M. E.?

Editor American Machinist:

Having long been an admirer of the AMERICAN MACHINIST on account of the excellent work it has been doing as an educator of American mechanics and mechanical engineers, it is with regret that I notice in an editorial in its issue dated September 5th, what I conceive to be an erroneous view concerning the meaning of the letters M. E. when placed after a man's name, and the right of any person to place them after his name. The editorial in question conveys the impression that these letters mean simply that the man is a mechanical engineer, or that he practices mechanical engineering for a living; that they are a descriptive title of the same kind as the words "machinist" and "boiler maker," and that they may righly be used by any one who considers himself a mechanical engineer.

Will you allow me to enter a protest against this view, and to state my own opinion, which is: 1st. That the letters M. E. mean not that the man *is* a mechanical engineer by virtue of his having actually labored as such, but that he possesses a diploma conferring the degree of mechanical engineer, which diploma has been conferred upon him by a college having authority by law to confer such a degree. 2d. That no other person has any legal or moral right to use them. 3d. That while there may be no penalty attached by law to the wrongful use of these letters, such as there is in many States to the wrongful use of the letters M. D. (which mean that the user of them is the possessor of a college diploma conferring the degree of Doctor of Medicine) the man who uses them and who is not the possessor of a legally conferred diploma which entitles him to use them, is guilty of a willful deception of the public. It is possible that some who wrongfully use these letters are not guilty of willful deception since they are actually ignorant of their meaning, but they at least lay themselves open to the suspicion of willful deception, and if honorable men they will no longer use them after they become aware that such use renders them liable to such suspicion.

That the letters M. E. do not mean that the user of them is entitled to any special eminence as a mechanical engineer, gained by years of labor or great achievement is evidenced by the fact that not one of the eminent American engineers whose long experience and high reputation entitle them to the front rank as mechanical engineers, now uses these letters, or ever has done so. The late A. L. Holley, who was pre-eminently a mechanical engineer, used C. E. after his name, but never M. E. John Ericsson, Horatio Allen, Charles T. Porter, Charles E. Emery, A. H. Emery, R. H. Thurston, Charles B. Richards, John E. Sweet, E. D. Leavitt, Jr., and many other eminent engineers who might be named, never used the letters M. E., not having had the college diploma legally entitling them to use them, and they would scorn to do so without such legal right. Some of these, however, use the C. E. or the Ph. D., to which they are rightfully entitled by diploma, although they do not now practice civil engineering or that class of scientific research for which the degree of Ph. D. is granted.

Still further, the letters M. E. are (with possible rare exceptions) rightly used at the present time only by the younger men in the profession of mechanical engineering, and their use actually advertises the fact that the users are of comparatively limited practical experience, because they are young men. This results from the fact that it is but little over ten years since the degree of M. E. was

by which they may be surmounted. Various applications of ballooning are treated—the steering power, propelling power, air currents, etc., etc. The latest inventions proposed for solving the problem of controlled motion in a balloon are set forth, and illustrations of balloons given. Aside from its scientific and technical value, which are undoubted, the book is a very readable one. The price is $1.

The Miller, of Chicago, is a new monthly of which vol. 1, No. 3 is before us. It is intended to represent the interest of burr millers as opposed to the new roller mill system of grinding. It is a neatly printed paper, and is conducted in lively style.

The Black Diamond is a new journal just started in Chicago to represent the coal trade. The first number promises well.

In a recent English steam-engine invention the air pump, connected by return crank to the crank disk, is arranged so that steam can be admitted to it to help the engine off the center in starting.

"When we must design a special machine, we want to visit the place where said machine is to be used. We want to see the surroundings that machine is to have. We want to see the men who are to run it, and the material it is to utilize. If a man comes to us and says, 'I want to do such and such work in that town; I have got this material to work up, and I want a machine to do it well and economically,' then we tell that man we can't give him satisfaction until we have visited the exact locality, and have studied thoroughly the whole situation. Then we can do the matter justice." So said a machinery man in our hearing.

According to Superintendent Shannahan there was carried over the canals of New York in one week in August, 2,177,000 bushels of grain, while during the same week the railroads carried only 148,000 bushels. Yet we notice that there are people who believe the canals are of no use.

Last week we published a suggestion of a correspondent for flattening a spot on twist drills near the end of the shank and marking the size there, so it would not be obliterated the first time the drill slips in the chuck. Another correspondent writes us, asking why manufacturers of twist drills do not mark the size just where the twist terminates and the shank begins, where it would not be defaced by the jaws of the chuck. We respectfully refer the matter to the makers.

We infer from the following, which we take from the *Railway Review* (England) that trains are not always run in Britain as close on time as we are sometimes led to suppose:

When a train is booked to arrive at a certain point at half-past two, it doesn't improve the temper of those who travel by it to find it reaches its destination three-quarters of an hour after the advertised time. That this is not an uncommon occurrence on the Great Western Railway system, others besides myself can testify.

Does this account for the fast time we read so much of on English roads?

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials, nor location will be published.

(263) Engineer, Hoboken, N. J., asks: 1. What is the best and quickest way to cool a pump when it gets hot and will not work? *A.*—We have never found a quicker way than to deluge it with cold water. 2. What can you do to stop boiler tubes leaking at the tube-sheet? *A.*—Have a boilermaker reset the ends.

(264) D. R., Central City, Col., asks: 1. Is water a compressible fluid? *A.*—Water, for all practical purposes, may be considered incompressible. 2. Is the pressure of steam greater in a locomotive boiler at the back end than at the front end? *A.*—No. 3. Will an injector feed a boiler with less steam pressure at the front end of a locomotive boiler than at the back end? *A.*—No; not if the distance of feed below the surface is the same. 4. Which is the best stationary boiler, the one with a dome, or the one with an inside pipe? *A.*—Opinions differ. If properly constructed, probably one is about as good as the other.

(265) A. P. B., Columbus, Ohio, asks: Is it proper to oil the teeth of gear wheels? *A.*—It is a good plan to use a little oil on small wheels. Heavy gearing may advantageously have tallow applied to the teeth occasionally. 2. When a belt will not run true on pulleys, and the pulleys are in line, would cutting the belt a little out of square help it? *A.*—It might, probably, afford temporary relief, but the proper plan is to find why the belt will not run properly when laced square, and to remedy the difficulty. If the belt is laced true, the belt will run to one side if the pulleys are not turned true, or if the two shafts are not in line both ways, one with the other. A careful examination will probably show one or the other of these faults. You might try changing the belt end for end. 3. Is it good policy to wet the ashes in the ash pit of a portable engine before drawing them? *A.*—We do not believe it is a good plan to wet the ashes in any boiler where the water will come in contact with the metal. Dampness in the corners and seams is likely to start corrosion.

BUSINESS SPECIALS.

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Patents. Fees, $10 up. Write Hill & Co., 165 B'way, NY

Curtis Pressure Regulator and St'm Trap, Aug 15, p 12

J. Clayton, Air Compressors, Rock Drills 43 Dey st, NY

Edw. Sears, wood engraver, 48 Beekman st., N.Y.

Presses & Dies, Ferracute Mach. Co, Bridgeton, N.J.

Steel Name Stamps, &c. J.B. Roney, Lynn, Mass.

Tack, wire, and shoe nail machinery; Wm. A. Sweetzer, Brockton, Mass.

Treatise on gear teeth and bevel gears; specimen pp free. Geo B. Grant, 66 Beverly st., Boston, Mass

Consulting Engineer and Mechanical Expert, C. C. Hill, 84 Market st., Chicago, Ill.

The Best Upright Hammers run by belt are made by W. P. Duncan & Co., Bellefonte, Pa.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts., New York.

"How to Keep Boilers Clean." A book mailed free, by James E. Hotchkiss, 86 John st., N. Y.

Improved Labor-Saving Upright Drills; prices reasonable. Currier & Snyder, Worcester, Mass.

The latest Improved Tack and Match Machinery is made by White Machine Co., Waterbury, Conn.

Foot-Power Machinery for workshop use, sent on trial if desired. W. F. & Jno. Barnes, Rockford, Ill.

Lyman's Gear Chart. How to lay out gear teeth. Price, 50c. E. Lyman, C. E., New Haven, Conn.

Lathe tools, improved threading tools, cutting-off tools. Catalogue sent. H'tf'd Tool Co., Hartford, Ct.

Machines to form and bend steel and iron; run by power. Williams, White & Co., Moline, Ill.

Send ten cents for 98-page catalogue of scientific books. D. Van Nostrand, 23 Murray st., N. Y.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocum & Son's Shafting Works, Drinker st., Philadelphia, Pa.

Engine Lathes, Hand Lathes, and other fine tools. Assortment large; prices low. Frasse & Co., 62 Chatham st., N. Y.

Farley's Reference Directory of the Machinists', Iron, Steel and Metal-Working trades of the United States. A. C. Farley & Co., Philadelphia, Pa.

Files recut without drawing temper, about one-half usual prices; samples recut free; prices on application. The Acme Co, Collinsville, Conn.

The outline ("wax process") engravings shown in the AM. MACHINIST each week are made by Struthers, Servoss & Co., 24 to 34 New Chambers St., N.Y.

"Complete Practical Machinist," $2.50; "Mechanical Drawing Self-Taught:" $4. Books for workmen. Joshua Rose, Box 3306, New York City.

Patent Bolt Dogs, as illustrated in AM. MACHINIST of Sept. 5, sent prepaid anywhere in the U. S. upon receipt of $2.25. Fay & Scott, Dexter, Maine.

Morrison's Practical Engineer, a complete treatise on steam and general machinery, sent free on receipt of price, $1. Indicators, Engineers' Instruments and outfits. W. A. Morrison, Box 373, Lowell, Mass.

D. H. McAlpin & Co., N Y., the large tobacco manufacturers, say: "Hine & Robertson, 12 Cortlandt street, N. Y.—The Kellam Pressure Regulator attached to our steam system works very satisfactorily, and carries out all that was claimed for it."

Locomotive Engine Running and Management. By Angus Sinclair. Gives full directions about handling and repairing locomotives; instructs how to design valve gear and set valves; Westinghouse air brake explained by aid of engravings. Price, $2. For sale by *National Car Builder*, 187 Dearborn st., Chicago, Ill.

Every young man who aspires to be either a mechanic, merchant, or manufacturer, owes it to himself that he become thoroughly familiar with the writings of Chordal. John Wiley & Sons, 15 Astor Place, N. Y., have issued a new and enlarged 12 mo edition of "Extracts from Chordal's Letters." Handsomely bound in cloth, with over 50 illustrations. Price, $2. Discount of 25 per cent. on orders for five or more copies.

MANUFACTURES.

The D. L. & W. Railroad will erect a new round house.

Stephen Monsen will rebuild his foundry at North Albany, N. Y.

W. F. Meader & Co. are to build an elevator at Gibbon, Minn.

Allen & Kail will build a 50-barrel flour mill at Alfondsville, Ind.

Withgott & Dillahay will establish a machine shop at Easton, Md.

The Standard Silk Company are to erect a new mill at Phillipsburg, N. J.

W. U. Mattox and others, of La Grange, Ga., are to erect a cotton seed oil mill.

An iron bridge is to be built across the Susquehanna river at Williamsport, Pa.

Houston & Mills, of Akron, Ohio, contemplate erecting a foundry and machine shop at Dayton, Tenn.

John Wood, of Conshohocken, Pa., is converting the old car works at that place into a machine shop.

Wm. G. Selleck, Englewood, N. J., will build a $10,000 extension to the factory at 61 Ann street, New York.

Truxel & Dunnemeyer, machinists, Chattanooga, Tenn., will make an addition to their building to cost $12,000.

J. J. Craig will erect a building to be used as a lumber and marble mill at Knoxville, Tenn, at a cost of $100,000.

The Waterloo & Seneca Falls Railroad Co., will erect a building to be used as a roundhouse at Seneca Falls, New York.

Schoenberger & Co., Pittsburgh, Pa., will erect a large regenerator at their steel works, which will be run by natural gas.

The Chattanooga Ice Co., of Chattanooga, Tenn., will make repairs to their machinery and factory to the amount of $11,000.

Fichter & Martin, Allentown, Pa., will fit up an additional room, 120x40, with looms, etc., for the manufacture of silk ribbons.

Currier & Joy, Ellsworth, Maine, are completing more commodious buildings in which to prosecute their wood-working business.

The Eagle Manufacturing Co, Kansas City, Mo., will erect a five-story brick building to be used for manufacturing purposes. Estimated cost, $17,000.

All the cotton mills at Woodbury, Md., started on full time on or about the first of September. Some of them have been idle, and others running short time.

Walter S. Johns, 8 Noel Block, Nashville, Tenn., proposes starting a factory for the manufacture of machines for the cleaning and grading of peanuts and pecan nuts.

The roundhouse and repair shops of the Providence & Springfield Railroad, at Providence, R. I., are to be rebuilt by the company as soon as the insurance is adjusted.

Wilson, Walker & Co., of Pittsburgh, Pa., will at once commence the erection of an iron foundry to be connected with the coal mine supply department of their present mills

The Reading Foundry & Machine Co, of Reading, Pa., will erect a new pipe foundry, engine-house and office. The foundry will be 76x252 feet in size, and will be built this year.

J. H. Cheever, Treasurer of the New York Belting and Packing Company, is at the head of a new concern that will erect a large cotton bleachery at Passaic, N. J., to employ 260 hands.

McKee, Anderson & Co, Beaver Falls, Pa., will remodel their old sheet mill and put in a special set of rolls for rolling old steel rails into sheet bars. Natural gas will be introduced.

The Matthieson & Weichers Sugar Refining Co., of Jersey City, N. J., has purchased the old Adirondac steel works buildings of that city, with a view to the further extension of their business.

The Hoggson & Pettis Mfg. Co., New Haven, Conn., has purchased all rights in the "Sweetland" chuck, and will go on with their manufacture. The inventor, William L. Sweetland, is superintendent.

Two two-story factory buildings, each 200x80 ft., will be erected on Shunk street, Philadelphia, Pa., to be used as a salt manufactory. Penna. Salt Manufacturing Co., owners, 140 S. Del ave., Phila., Pa.

Wm. A. Sweetser, late of the firm of Sweetzer & Merritt, Brockton, Mass., has bought out the Brockton Machine Co., of that city, and will manufacture a full line of tack, wire and shoe-nail machinery.

The Malleable Iron Works, at Canton, Ohio, resumed operations on the 12th inst, after several months' idleness. The works started full in all departments, and expect to run throughout the winter.—*Iron Trade Review.*

The Tabor Manufacturing Co., 111 Liberty street, New York, has issued a new circular of the Tabor steam-engine governor. In addition to dimensions and prices of governors, it contains a discussion of the merits of throttling engines.

The Wichita Water-Power Co. have begun work on the dam at Wichita Falls, Texas, and in a few months they expect to have sufficient power to run any kind of machinery. A woolen and flour mill will probably be erected in a short time.

Reed Bros., tack manufacturers, Brockton, Mass, will erect a large rolling mill near their present factory. It will be fitted up with the latest and most improved machinery for their purpose, and when finished will be one of the largest rolling mills in that section.

An elevator company has been organized in connection with Evans' line of boats on the Missouri, to buy and ship grain at all river landings between Pierre and Bismarck, and elevators will be built this fall at Fairbanks, Libeau, Scranton and La Grace.—*Northwestern Miller.*

A meeting of prominent Rhode Island manufacturers was recently held at Providence, at which a resolution was passed protesting against reopening the tariff agitation at the coming session of Congress. The preamble expressed a belief that business prospects were more hopeful.

A company has been incorporated at Belleville, Ill., with a capital of $30,000, for the manufacture of the Schwartzweidelder wheat-scouring machine. By one or two changes the machine can be made to shell rice. The company are completing their organization, and will erect works.

The two 500 horse-power engines, built by the Watts-Campbell Company, of Newark, N. J., for the elevated wire rope road in Jersey City, have been tested for driving the machinery of the road with entirely satisfactory results. It is expected that the road will soon be in operation.

The Norwich (Conn.) *Bulletin* says that the sales in manufactured goods in Norwich were greater in July than for the corresponding month for five years. Prices are said to be low, but the goods on hand are being rapidly disposed of. The *Bulletin* thinks the chances for improvement in business are good.

The South Tredegar Iron Co., Chattanooga, Tenn., have shipped an eighty-pound package of their steel nails to the Edgar Thompson steel mill as a sample. Several of them were driven into a 3-inch dry oak plank without the least sign of bending or cracking, and were clinched on the other side.—*Age of Steel.*

The Standard Watch Company, of Jersey City, N. J., has broken ground for the erection of buildings for manufacturing watches. Their new movement, called the "screw movement," is said to greatly simplify the mechanism of the watch. The buildings will consist of main building 100x30 feet, four stories high, and an extension 30x30 feet. It is said that 500 hands will be employed. It is expected eventually to manufacture clocks, made on the same principle as the watches.

The Abendroth & Root Mfg. Co., 28 Cliff street, New York, have recently increased their capacity to manufacture their "New Root Boiler" by erecting new tools of special design, and engaging the services of capable engineers to attend to that special branch of their business. They have quite recently made some decided improvement in the method of construction, which improve the appearance as well as add to the efficiency of the boiler. Among the more important improvements are the use of expanded joints in place of numerous cap joints, as formerly; a heavy front of pleasing design, and the housing in of the tube heads. The framework for supporting the heating surface is also done away with, and the whole supported entirely independent of the brickwork, thus positively avoiding all cause for the cracking of the latter. We learn that, when required, each boiler is tested up to 500 pounds hydraulic pressure after erection, and before enclosing in the brick work, and that several are now in operation carrying from 125 to 250 lbs. steam pressure. We expect soon to publish a full description, with illustrations, of the improvements mentioned.

The Cedar Point Iron & Steel Company are building a Clapp-Griffiths converter, to be operated in connection with their blast furnace, this being the first company in this country to adopt the process for use with the blast furnace. At Belleville, Ill., the Belleville Nail Company are building a steel plant to be operated by the Clapp-Griffiths process. The Glasgow Iron Company, of Pottstown, Pa., have increased their capital stock for the purpose of erecting a Clapp-Griffiths steel plant. The Danville Nail Manufacturing Company, of Danville, Pa., have also increased their capital stock to erect a steel plant, which will undoubtedly be operated by the Clapp Griffiths process. The Pottstown Iron Company, at Pottstown, Pa., have erected a building for a steel plant, but the kind of plant to be built has not yet been made public. Representatives of the firm of A. McDonald & Brother, of St. Louis, have been examining the Clapp-Grffiths steel plant at Pittsburgh, with a view of adopting the process. At the Trenton Iron Company's works, at Trenton, N. J., one of Gordon's stationary steel converters is now in course of erection, to be operated upon the pneumatic principle. The plant will be in operation this month. At Birdsboro, Pa., the E. & G. Brooke Iron Company are building a new steel converter to produce steel by the same process.

The water supply of Hamilton, Ont., is to be increased.

The citizens of Wellsboro, Pa., have already subscribed $50,000 towards erecting water-works.

Bids for furnishing boilers and pumping machinery for the water-works at Champaign, Ill., were opened on the the 21st inst. As all the figures named were considered excessive, the entire lot were rejected.—*Manufacturers' Gazette.*

Machinists' Supplies and Iron.

NEW YORK, Sept. 3, 1885.

It is unquestionable that the feeling both in supply business and manufacturing is more hopeful. While the advance in business is so slight as to be hardly noticeable, it is very generally believed that there is a movement in the right direction. Prices are low, too low for both buyer and seller, when the best interests of all are considered, but it is believed that there must soon be advances, and this is influencing buyers to inquire if this is not a good time to buy. Stocks of manufactured goods are low, and a little additional demand must tend to stiffen prices.

Iron—In American pig the market has ruled steadier, and inquiries are more numerous, showing an inclination of consumers to replenish their stocks. In some instances there is evident intention to contract for future supplies. Dealers are less willing to accept concessions, all of which tends to a firmer tone, more satisfactory to furnacemen. Standard Lehigh brands are held: No. 1 X Foundry, $18, with outside brands $17.50; No. 2 Foundry is quoted at $16 to $16 50; Grey Forge, at furnace is still quoted at $13.50 to $14 50.

Scotch Pig—But few sales are made, and these at concessions. There is but little life in the business. We quote Shotts $19.50 to $20; Coltness, $19.50 to $20; Glengarnock, $18 50 to $19; Gartsherrie, $19.50; Summerlee, $19 to $19.25; Carnbroe, $18.50 to $19; Eglinton, $17.50 to $18; Langloan, $19.50 to $20; Dalmellington, $18 to $18.25

Copper—The market for ingot is steadier. Dealers ask 11¼c. to 11½c. for Lake, with 10.75c. offered. Other brands are quoted 10¾c. to 10¾c.

Lead—Some sales have been made at 4 25c., but buyers and sellers do not seem inclined to meet on these figures. Asking price is 4 30c

Tin—The market is quiet, with only small lots offered, and not much inclination to buy. Jobbing lots of Banca are quoted at 20¾c.; Straits and Malacca, 20¾c. to 21c.

Antimony—Hallett's 8¾c.; Cookson's 9¼c.

Spelter—Refined, 4.75c. to 5c.

WANTED

"Situation and Help" Advertisements, 30 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Machinist wants a job. Box 477, Salem, Ohio.

Position wanted as foundry foreman; practical; good ref'nce. Address M.E. Chanic, AM. MACHINIST.

Wanted—A practical foreman for a pipe foundry; one having some capital to invest preferred. Address Pipe Foundry, AM. MACHINIST.

Chilled plow man, with long experience, and can work colored labor in foundry, is open for engagement. Address Plows, AM. MACHINIST.

Wanted—Situation as draftsman, by a young man who has mechanical education and practical experience. Good ref. Address B., AM. MACHINIST.

A young man, at present engaged in designing and superintending the construction of machinery, wishes to invest his services and from $2,000 to $3,000 in an established business. Give full particulars. Address Energetic, AM. MACHINIST.

A thoroughly practical mechanical engineer, with progressive ideas, who has held good positions, and understands the economical manufacturing of light machinery and small articles, and the designing of special machinery and tools for the same, is open for an engagement. If you want such a man, and are willing to pay a fair salary for intelligent work, address J. B. H., Box 3376, Boston, Mass.

MISCELLANEOUS WANTS

Advertisements will be inserted under this head at 25 cents per line, each insertion.

Engineering specialties; send for price-list. Crescent Mfg. Co., Cleveland, Ohio.

To make room for larger tool, will sell cheap, for cash, a planer 42"x42" x12', in good order. Address P. O. Box 3085, Bridgeport, Conn.

Cheap for Cash.—A 60-inch Newton Half-Automatic Gear Cutter, used one year. Good as new. E. Gould & Eberhardt, Newark, N.J.

For Sale—28"×16' engine lathe, 36" planer, 60" pulley lathe, 3 small lathes, 28"×24' shafting lathe, 3 drill presses. A. G. Brooks, 261 N. 3d st., Phila., Pa.

Experimental machinery built; details worked out; shortest notice; reasonable terms. Pennington & Mills, 8 Dey st., Jersey City Heights, N J.

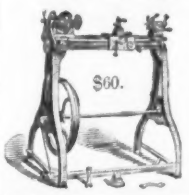
Wanted—Responsible parties selling to steam users, or dealing in mill supplies, to handle several first class articles new and easy to sell. Address Kelley & Downing, Erie, Pa.

Wanted—New or good second hand tools. One lathe, 30"×16' or 20'; one 20"×10' or 12'; one 16"×8' bed; one planer, 30"×8' or 10'; one planer, 36"×10' or 12' bed; one drill press, geared 30" swing; one 20" lever bolt-cutter; shaping machines, etc. Parties having second-hand tools for sale should address "California" AM. MACHINIST.

PATENT SOLICITORS

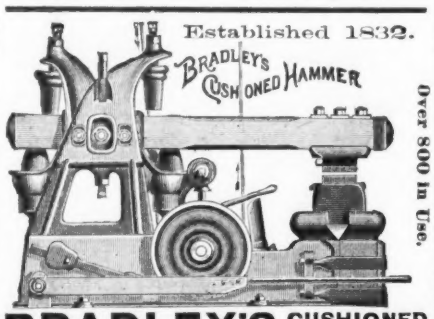
ELLSWORTH & YANTIS, 816 F St., Washington, D.C. Send for Circular.

CHANDLER & FARQUHAR,
177 & 179 Washington St.,
BOSTON, MASS.



TOOLS AND SUPPLIES
—FOR—
Machinists, Plumbers, Gas Fitters, Electricians, Model Makers, Roller Skate Makers, Amateurs, etc.
Send for Catalogue B.

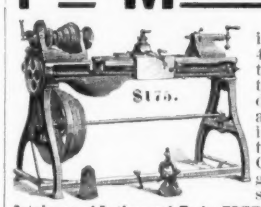
Established 1832.



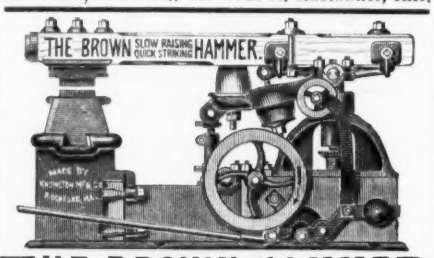
Over 800 in Use.

BRADLEY'S CUSHIONED HAMMER.
Stands to-day without an Equal.
It approaches nearer the action of the Smith's Arm than any Hammer in the WORLD.
SPECIAL NOTICE.
All parties making, selling or using an Upright or Helve Power Hammer having a Cushioned Vibrating Saddle, infringe our patents, and we shall hold them legally liable for the same.
BRADLEY & COMPANY, Syracuse, N. Y.

FOR MACHINE SHOPS.



This LATHE, swinging 14 inches over bed, 46 inches between centers and 22x4 inches in the gap, is specially designed for machine and jobbing shops. It is arranged with either Foot Motion or Countershaft, and is guaranteed to be substantial and accurate.
Catalogue of Lathes and Tools FREE. LATHES on TRIAL.
SEBASTIAN, MAY & CO., 167 W. 2d ST. CINCINNATI, OHIO.



THE BROWN HAMMER
STRIKES A BLOW WITH
DOUBLE THE VELOCITY That it Raises the Hammer.
A NEW MOVEMENT! SEND FOR DESCRIPTION.
KNOWLTON MFG. CO., King St., Rockford, Ill

STEPHENS PATENT VISES.

50 Per Cent. of time and labor saved by using this solid, strong, durable, quick-working Vise. Has the improved taper, pipe and other attachments. Sold by the trade. Send for circular.
MELVIN STEPHENS, Prop'r, Office, 41 Dey St., New York.

FOR SALE AT A BARGAIN.
A well established and good paying machine shop and foundry, including buildings, lots, machinery and stock, situated in Leadville, Col. The business will be carried on until sold, thus at once giving a profitable trade to the purchaser. Address,
A. FALKENAU,
Care of Dickson Mfg. Co.,
Scranton, Pa.
Only reason for selling, ill health.

251 *pages, 6 plates, 58 illustrations, 8 vo, cloth.* $5.00.
TREATISE ON
VALVE-GEARS
WITH SPECIAL CONSIDERATION OF THE
LINK-MOTIONS OF LOCOMOTIVE ENGINES,
BY DR. GUSTAV ZEUNER.
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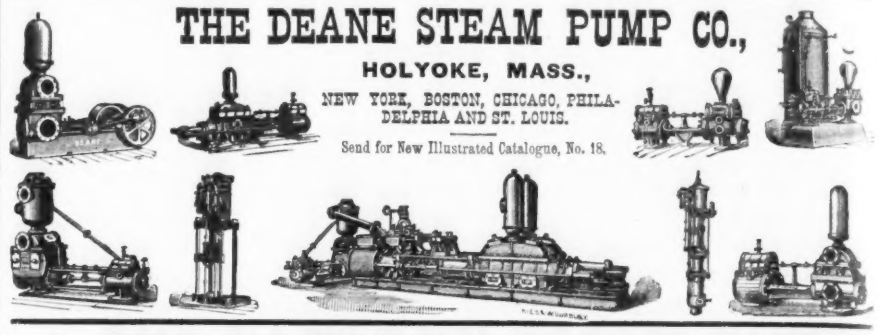

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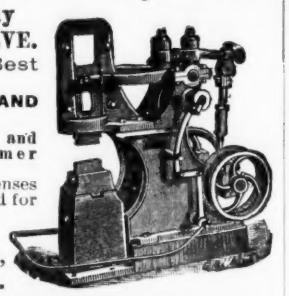

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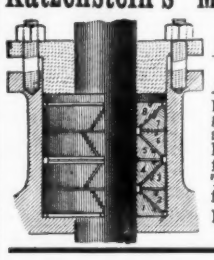

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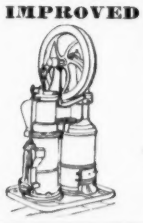

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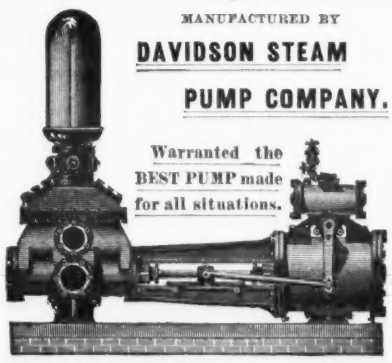

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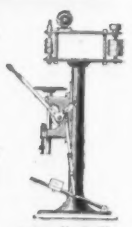

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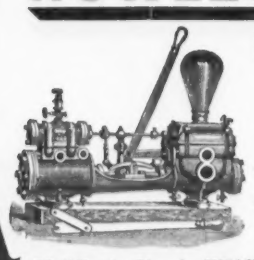

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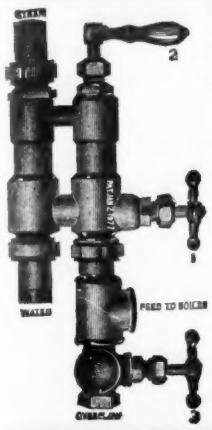

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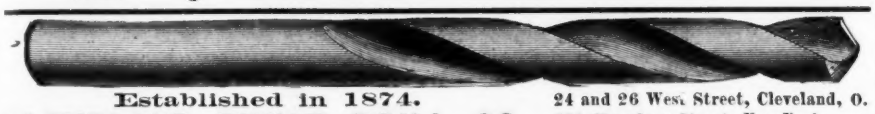

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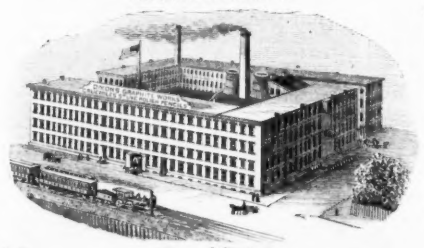

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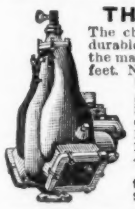

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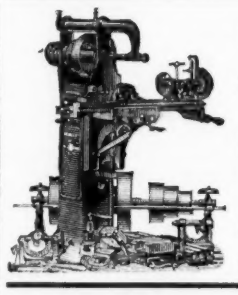

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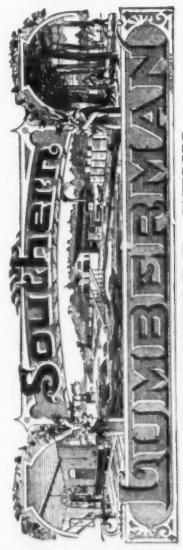

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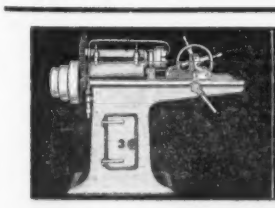

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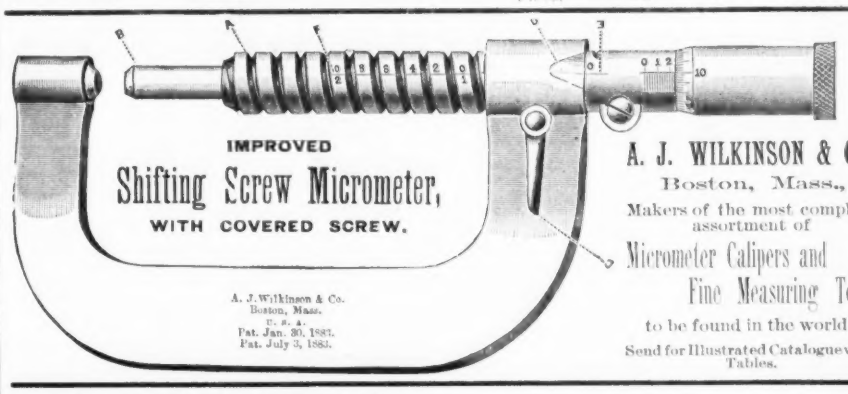

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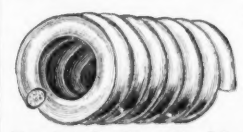

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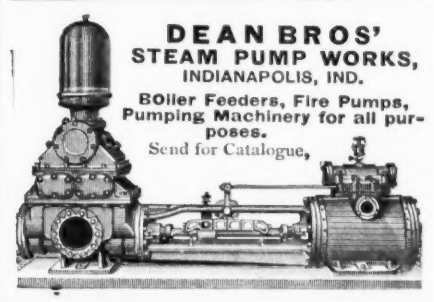

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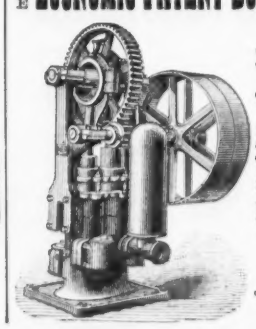

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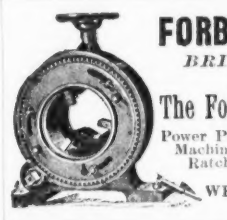

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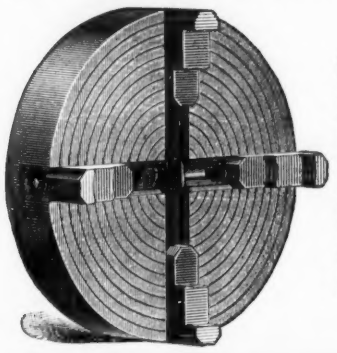

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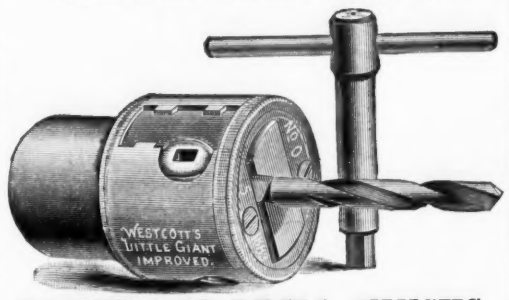

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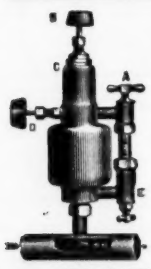

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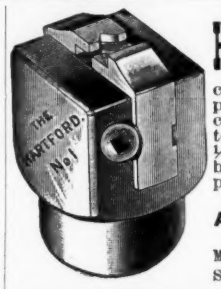

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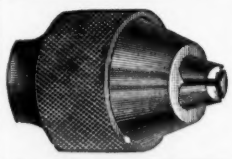

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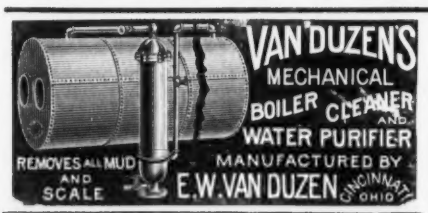

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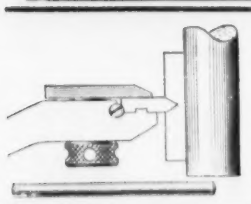

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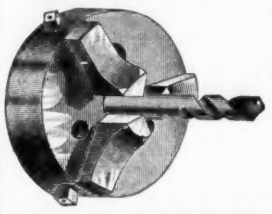

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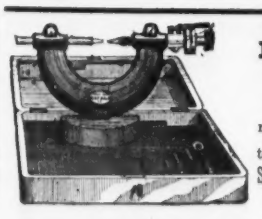

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Week before last we published, under this heading, references to a small portion of the practical articles that have been specially prepared for the AMERICAN MACHINIST, and have appeared in our columns during the last few months. Last week we published an additional list. We append another list below. No other mechanical journal in this country has or ever has had such a collection of practical articles, by writers of well known ability, as are presented in these columns week by week. Every issue gives information that is taken up and applied in the shops and factories in various parts of the country. Copies containing these articles can be readily obtained by ordering of any newsdealer, or by writing to this office, at 5 cents per copy.

J. C. Hoadley.

Unbalanced Bodies in Revolution. March 14, 1885
Diagram Showing the Inertia of the Reciprocating Parts of the Steam Engine. June 7, 1884
Inertia of the Reciprocating Parts of the Steam Engine. June 7, 1884; September 13, 1884

J. D. Campbell.

Fitting and Care of Axle Boxes. August 3, 1884
Draft Regulating Appliances. March 15, 29; April 12, 26, 1884
Fitting Locomotive Wedges. August 16, 1884
Driving Boxes and Wedges. September 27, 1884
Building Locomotives in Repair Shops. February 9, 1884
Locomotive Draft Appliances. April 25, 1885.

Robert E. Masters.

Moulding Ammonia Boilers. November 15, 22, 1884
Cutting Down the Face of Gear Wheels in the Mould. October 25, 1884
Moulding Balance Wheels. August 2, 1884
Portable Cupola. December 13, 1884
Cupola Management. May 17, 1884
Melting in a Southern Foundry. April 12, 1884
Melting Small Quantities of Iron. June 14, 1884
Melting Steel in an Ordinary Cupola. August 23, 1884.
Casting Rolls with Shaft in Them. May 9, 1885.
Economy in Using Small Cupolas. May 16, 1885.
Steel Castings. Aug. 15, 1885.
Casting Steel in an Ordinary Cupola and Publishing the Process. July 25, 1885.

Jas. F. Hobart.

Selecting and Using Files. January 10, 1885
Hammer and Grindstone. January 17, 1885
Emery Grinding. January 24, 1885
Forge, Anvil and Lathe. February 28, 1885.
Grinding and Using Cutting Tools. April 18, 1885
Doing Jobs on Sunday. May 30, 1885
Examination of Stationary Engineers. August 22, 1885
Engineers' Societies—Small Things—Babbitting Boxes—That Hog-nose Drill. August 1, 1885
Against Sunday Work. July 18, 1885

Angus Sinclair.

Chicago Limited Express. January 5, 1884
Fuel Economy with Locomotives. July 5, 1884
Locomotive Engine Running. February 9, 23; March 8, 22; April 5, 19; May 3, 17; June 7; August 16; November 1, 1884
Locomotive Economy. January 17, 1885
American Locomotives Built in 1884. January 24, 1885
Railroad Snow Plowing. January 19, 1884
How the Fastest Train in America is Run, January 5, 1884
Work of Pulling a Heavy Freight Train. November 22, 1884
Water for Locomotive Boilers. September 20, 27, 1884.
Efficiency of Brakes. January 10, 1885

Harris Tabor.

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Centrifugal Force in Revolving Bodies. April 4, 1885

Prof. Jno. E. Sweet.

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The Perfect Screw Problem. July 19, August 3, 1884
Proportioning Slide Valves and Determining the Effect of Different Proportions. August 16, August 30; September 6, 27; October 4, 11, 1884

A. J. Stevens, Gen. M. M., C. P. R. R.

Performance of a Locomotive. February 2, 1884
Correction of Boiler Criticism. January 3, 1885
Indicator Diagrams from the Largest Locomotive in the World. January 10, 1885
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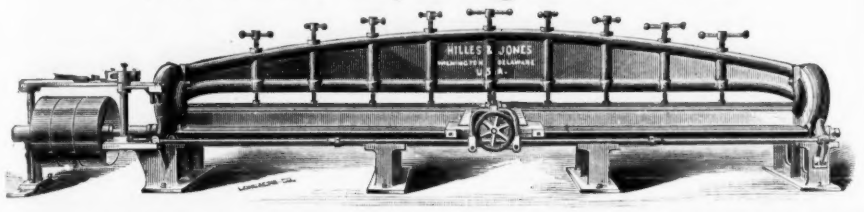

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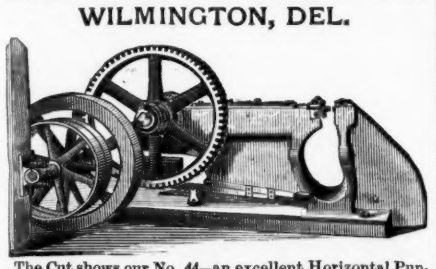

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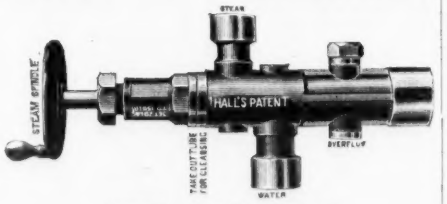

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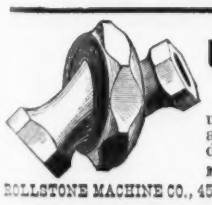

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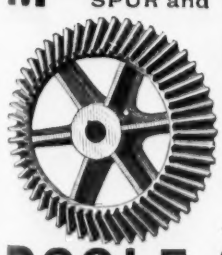

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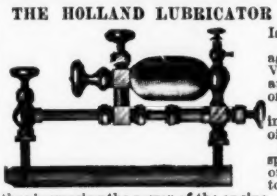

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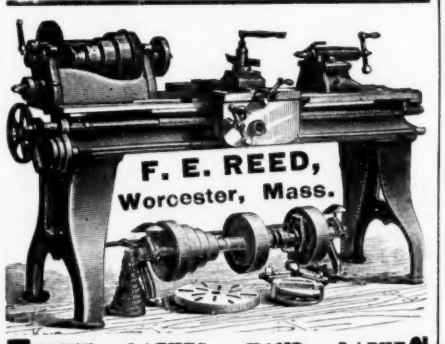

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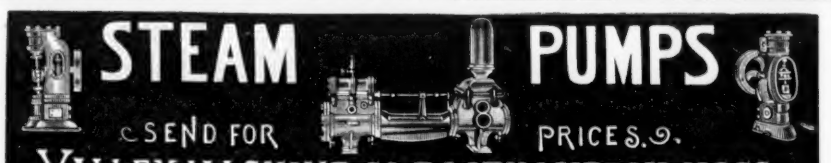

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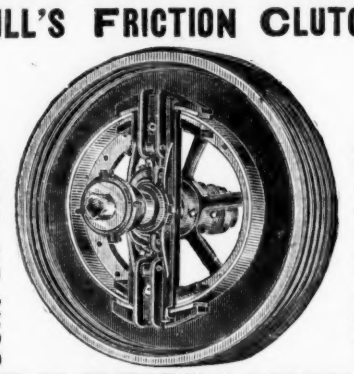

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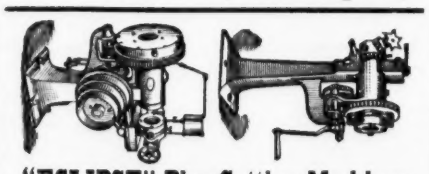

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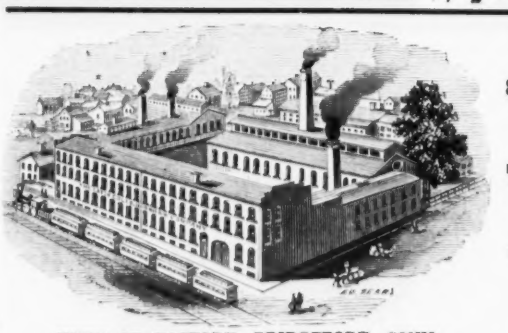

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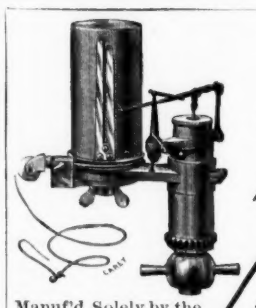

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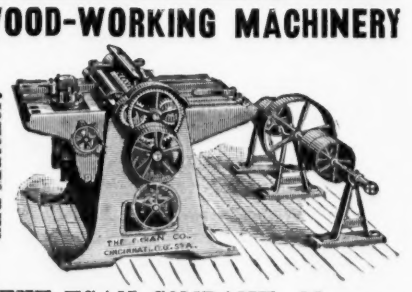

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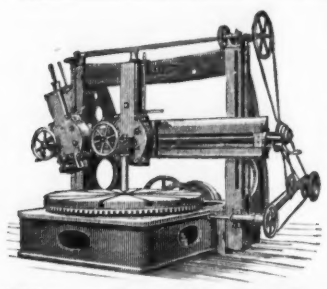

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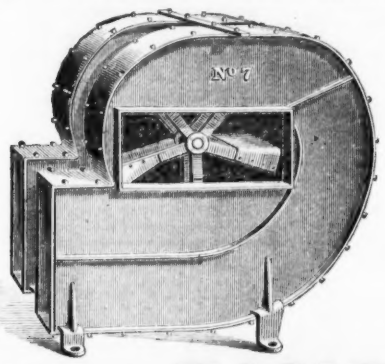

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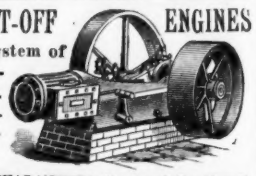

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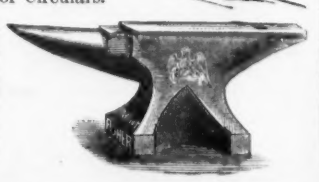

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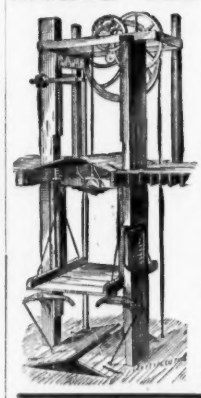

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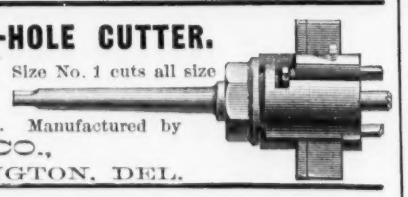

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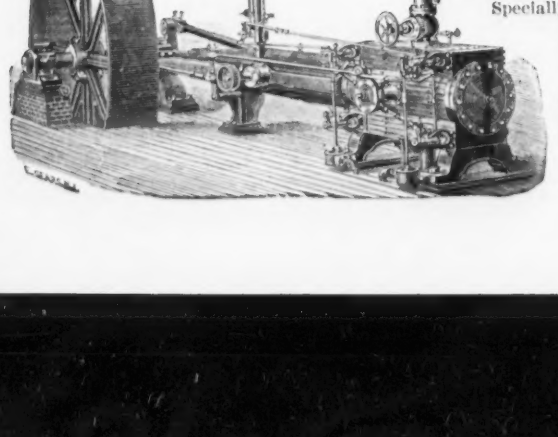

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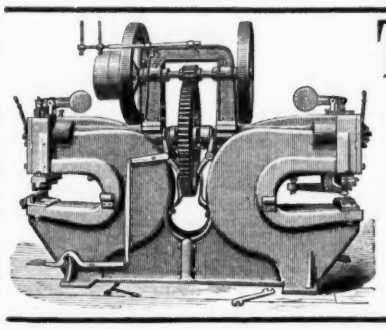

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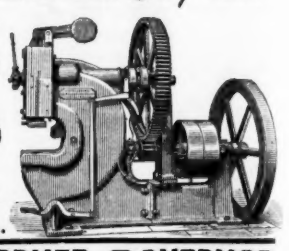

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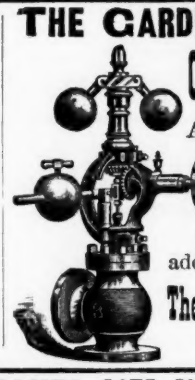

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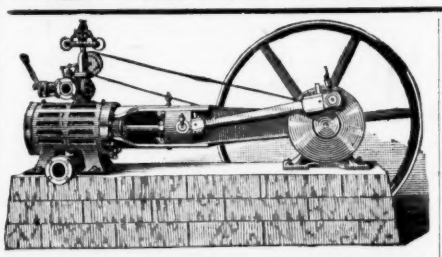

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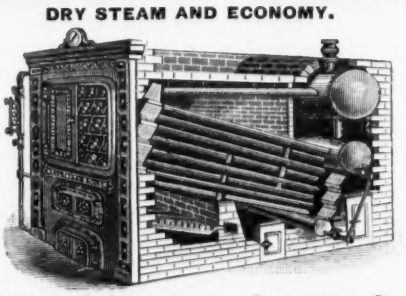

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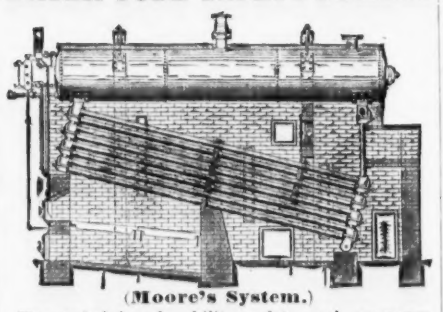

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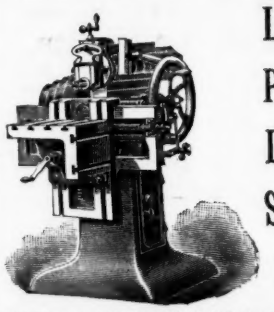

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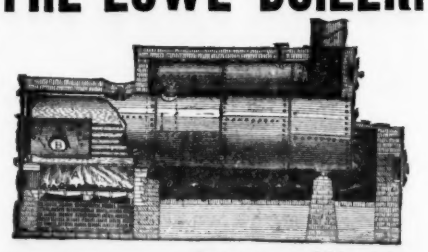

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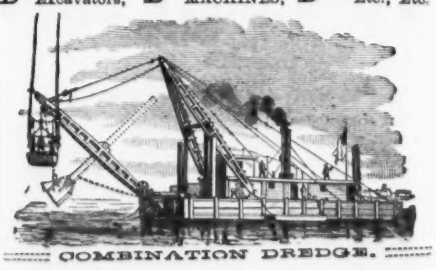

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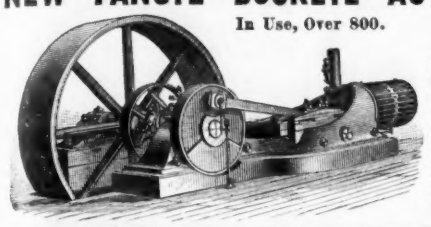

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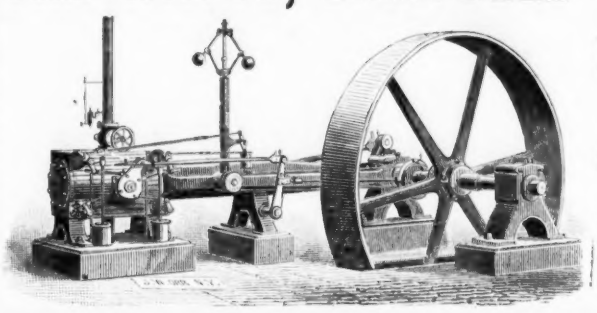

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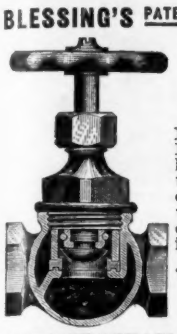

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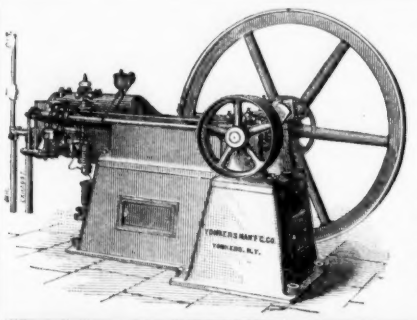

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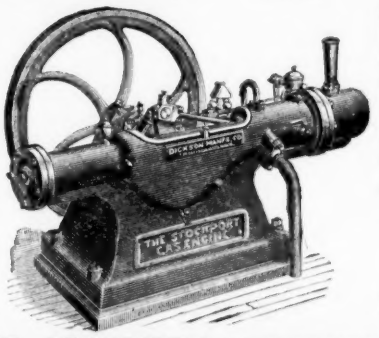

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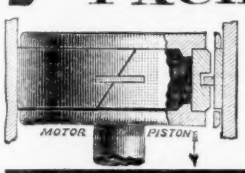

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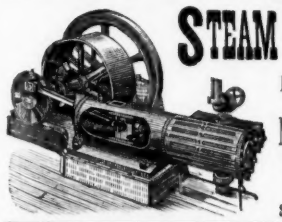

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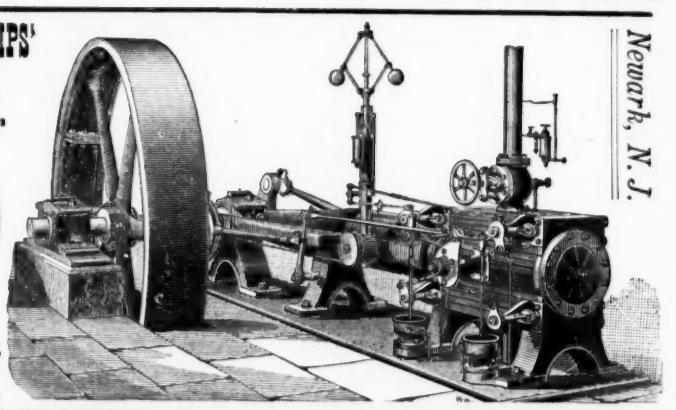

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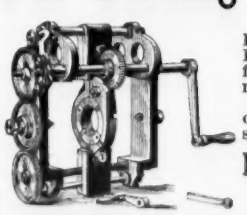

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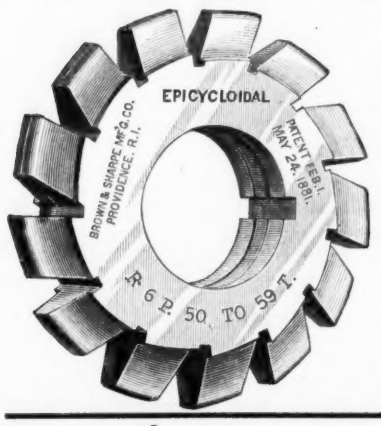
FOR THE TEETH OF GEAR WHEELS,

Which can be Sharpened by Grinding without changing their form.



We are prepared to furnish cutters of Epicycloidal form, which are sharpened upon the face the same as the Involute Cutters. As gears of this form of teeth to run well must be cut accurately to the proper depth, that the pitch lines may coincide, we make the cutters with a shoulder (see cut), which determines the exact depth that the gear should be cut; so that care taken in sizing the blanks obviates the necessity of any measurements in cutting the teeth. The Cutters are made for either diametral or circular pitches, and the same rules apply in finding the diameters of blanks as in our system of Involute teeth (i. e.), 2 pitches added to the diameter at pitch line.

These Cutters will cut gears which are perfectly interchangeable. The white line on edge of the two left hand upper teeth of cut is left for the purpose of placing the Cutter central with work spindle. The Cutters are marked with letters from A to X, by which they may be ordered.

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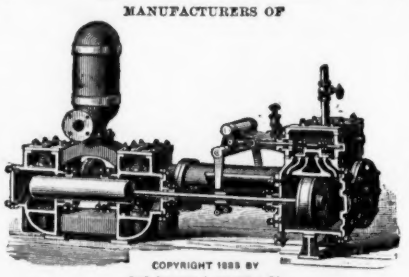

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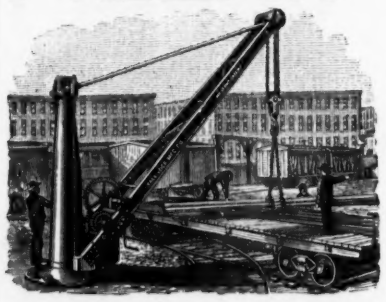

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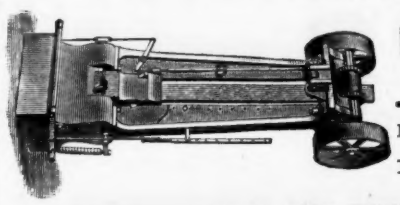

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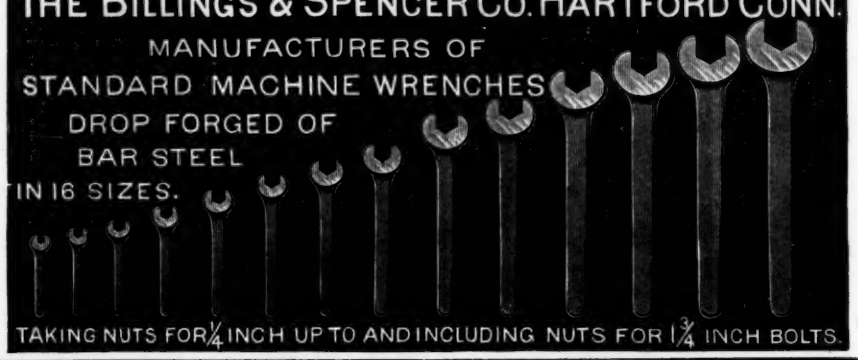

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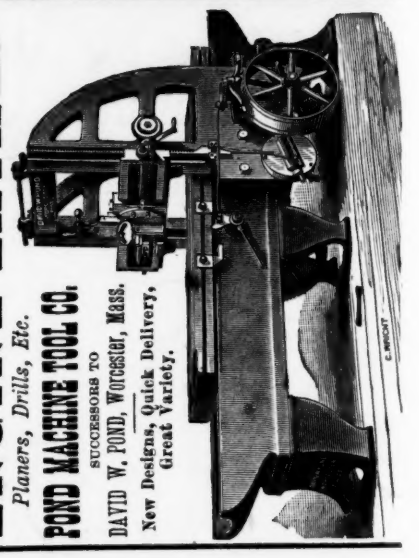

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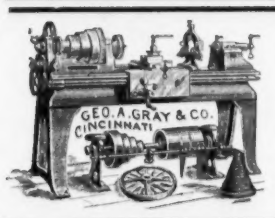

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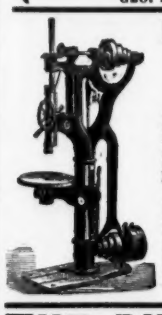

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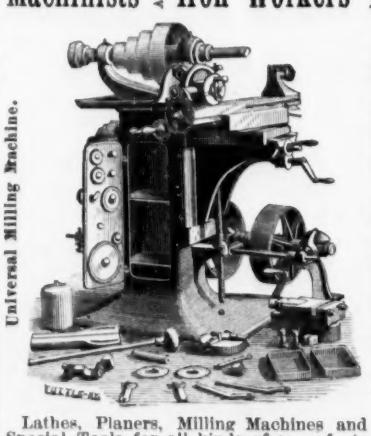

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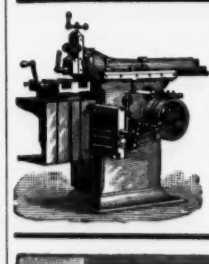

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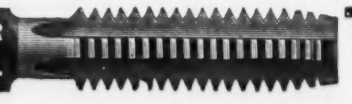

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